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BY

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PART VI.—LAKES AND SWAMPS.

ORIGIN.—A lake may be defined as a basin-shaped depression on the land, more or less completely filled with water. A depression along the sea shore, and partly connected with the ocean, is not commonly considered a lake, though when disconnected by the growth of a sand bar, such a body of water is often, and very properly, known as a pond or lake. Between pond and lake neither a popular nor a scientific distinction can be drawn, though, speaking very generally, the smaller bodies are ponds, the larger lakes.

A basin-shaped depression in the land surface is not a common production of the action of running water alone, although small basins of this origin are actually produced. For instance, a stream flowing over soluble rock, as limestone, very frequently dissolves tiny basins in that part of the stream bed where the rock material is most soluble. Again, the water at the base of a cataract frequently excavates a basin in which a deep pool stands, and this, with a change in direction of the river, or its removal for any other cause, may become a pond. (See p. 12).

Speaking generally, and bearing in mind such minor exceptions as these, it may be said that lake basins are rarely carved by the water that occupies them. Nevertheless, lakes may be considered to be parts of rivers, where locally, and for some cause, the normal slope of the river bed has been changed to a concave surface. There is such an exceedingly complex series of causes for these basins, that at first thought they would seem to defy an

attempt at classification. One of the best attempts at such a classification is that by Davis,* in which origin is used as a basis. In this paper the general subject of the origin of lakes is discussed, and numerous instances cited for the various classes. In a later note † Davis proposed to substitute another basis for lake classification, considering them as parts of rivers changed to basins either as a result of accident or in the course of normal river development. It is that idea of Professor Davis which is followed in this brief consideration of New York lakes.‡

ORIGINAL CONSEQUENT LAKES.—In any *new land* surface, of whatever origin, basin-shaped depressions may exist. If the water supply were sufficient, lakes would fill the depressions, and these, being consequent on the initial or original topography, may be called *original consequent lakes.* For instance, the deposits that are now being made upon the sea bottom are not being laid down with perfect uniformity, so that numerous basins exist there. Illustrations of such basins are found in large numbers in the lakes of the Florida Everglades region, which is a raised sea bottom. There are now no instances of this class in New York, though when the plains were raised at the close of the Palæozoic, there must have been such depressions.

Very similar to these basins are those formed on the beds of lakes by irregularity of the sediment deposit. When for any reason the lake waters recede, these basins become independent lakes. There is a rim of old lake bottom around the shores of Lakes Erie and Ontario in which there are numerous ponds and lakes, some of which are in original consequent basins in the constructional lake bottom topography.

A surface constructed by any other means may possess original irregularities. For example, the surface of a lava flow may be irregular, though of this class no examples would be expected in this State. They abound, however, in regions where lava flows have recently occurred. Ponds not uncommonly gather in the crater-shaped depressions amidst sand dunes, as along the Long Island shore. We find abundant illustrations of original consequent lakes in the depressions existing in beds of till, or moraine, or stratified gravel,§ or other deposits resulting directly or indirectly

* Proc. Boston Soc. Nat. Hist., 1880–82, XXI, 315–381.

† Science, 1887, X, 142.

‡ For an excellent discussion of lakes see Russell, Lakes of North America, Ginn & Co., 1895.

§ Fairchild, Journ. Geol., 1898, VI, 589–596.

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from the glacial invasion. Still another class of original lake is that which must have existed on the surface of the ice itself when it covered the State. These temporary ice-surface lakes are common on the Greenland ice sheet to-day.

Lakes of Normal Development.—By these are meant those which are formed in the course and as the result of the normal development of rivers. Two instances of these have been mentioned above (p. 1); and another, similar to them because of its direct relation to the existing stream bed, is the tiny basin so often caused by the irregularity of *deposit* in the stream bed. One sees this particularly well illustrated in the semi-arid regions, as in Central Texas, where, during the dry season, the stream bed becomes transformed

FIG. 3.—OX-BOW-CUT-OFF LAKE IN CONNECTICUT VALLEY, NORTHAMPTON, MASS.

to a series of dry bars with ponds between. So marked is this feature that it has come to be symbolized on the topographic maps, where such intermittent streams are marked by a dotted line.

A larger illustration of lakes of normal development may be found upon floodplains. Such a plain is the direct result of the normal development of a river and in the course of its formation the stream that builds it meanders about over it, frequently abandoning one curve and commencing another. In this way a second channel is carved in the floodplain; and the first being

separated from the main stream, then becomes a true lake, the dam separating it being river floodplain deposit. Such lakes are strikingly developed on the Mississippi River floodplain (Figs. 1 and 2), where, in some cases, they have the shape of perfect meanders or ox-bow curves. If cut off by a change in the river, they are known as ox-bow-cut-off lakes (Fig. 3). On the floodplains of many of the large and small streams of New York this class of lake is well illustrated by linear ponds in which all stages of separation from the main stream are found.

Where streams have built deltas the irregular growth of the delta front, combined with the action of the waves, often forms ponds or lakes. These are admirably illustrated on the growing Mississippi Delta by some of the large lakes, which are entirely

FIG. 4.—POND FORMED BY IRREGULAR GROWTH OF DELTA, LUDLOWVILLE, N. Y. (C. S. DOWNES, PHOTOGRAPHER).

inclosed, and by some of the arms of the sea which are partly inclosed. The same cause operates in the growth of lake deltas; and ponds of this type are common on the deltas which are being built in the New York lakes (Fig. 4).

By the deposit of sediment in river courses, lakes and lake-like expanses may be caused. For instance, the Mississippi River, above the mouth of the Chippewa, is transformed to a quiet body of water known as Lake Pepin. This quiet stretch, which is *called* a lake, is the result of a dam built of sediment brought down by the Chippewa and deposited in the Mississippi, which was unable to carry it further. Tiny illustrations of this same condition are found in this State.

The growth of sand and gravel bars across bays at the mouths of rivers often transforms them to true lakes. One may see numerous illustrations of this along the shores of Lakes Ontario and Erie, and also along the Long Island coast. Here there is every grada-

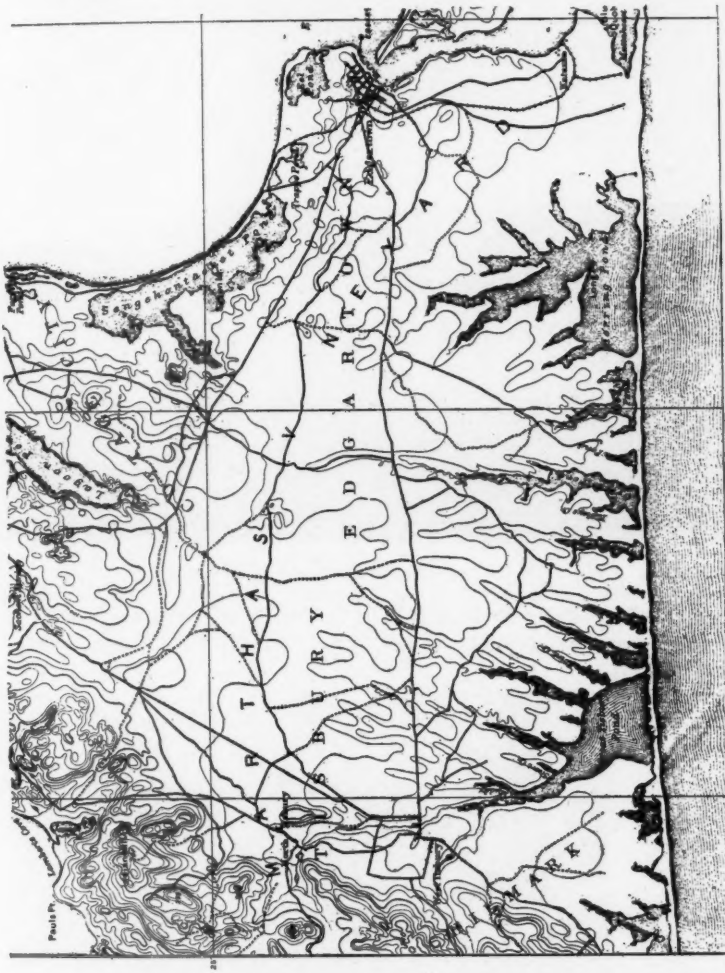

FIG. 5.—PONDS FORMED BY SAND BARS ACROSS THE MOUTH OF BAYS, MARTHA'S VINEYARD, MASS. (U. S. GEOLOGICAL SURVEY TOPOGRAPHIC MAP).

tion between the open bay and the lake caused by complete closure (Figs. 5 and 6).

In the course of the normal development of certain streams peculiarly located the drainage may become underground. This is

FIG. 6.—A BAR SHUTTING IN A POND, GRAND MANAN.

particularly liable to be the case in limestone regions where the water dissolves an underground channel for itself. In places this

FIG. 7.—A SINK HOLE IN THE LIMESTONE REGION OF KENTUCKY.

causes a settling of the surface, forming sink-holes (Fig. 7) in which lakes often gather (Fig. 8). The removal of any soluble substance, as salt, may cause the same kind of basin. While lake

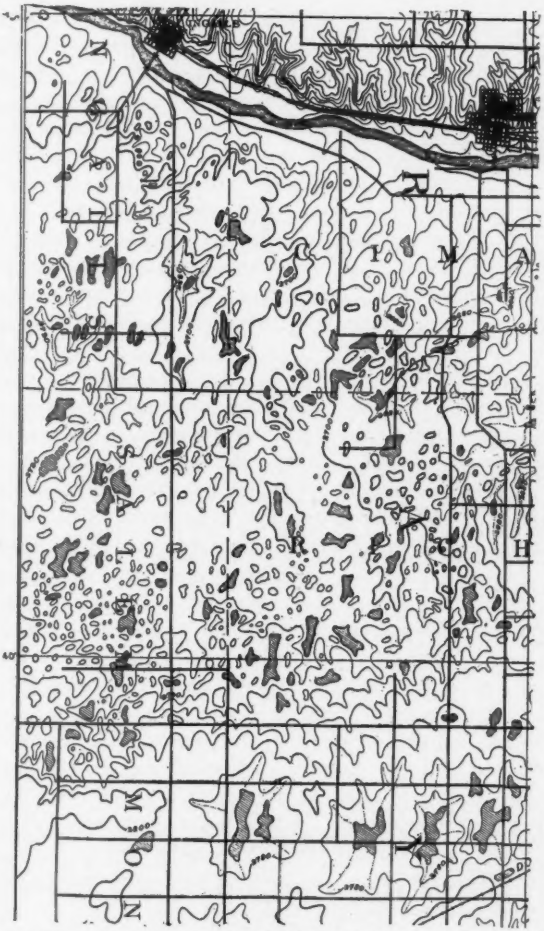

FIG. 8.—PONDS IN SINK-HOLES NEAR DODGE CITY, KANSAS (U. S. GEOLOGICAL SURVEY, DODGE SHEET).

basins of solution origin are very common in places, few have been discovered in New York. There are illustrations of this class of lake near Union Springs on the shore of Lake Cayuga.

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Lakes Due to Accident.—One of the most common ways in which river slopes have been locally changed to basins is by the development of some dam across a river course. Such dams are commonly due to some accident by which the normal development of the river has been interrupted. For instance, the early settlers of New York found hundreds of ponds and swamps caused by the dams thrown across small streams by beavers. Some of these still exist, and in parts of the continent, as in Canada and the Rocky Mountains, beaver dams are even now being constructed.

A landslide or an avalanche may obstruct a stream course and transform it to a lake. Among lofty mountains, as in the Himalayas, vast dams of fallen rock have formed good-sized lakes, and in New York there are instances, though very much smaller.* The dams formed in New York are generally caused where a stream, eating at the base of a bank of glacial till, has caused a slide to occur, which has temporarily transformed the stream to a pond above the dam.

The movement of the earth's crust during mountain building oftentimes throws insurmountable barriers across stream courses. As the mountain chain rises higher and higher, it may so interfere with the drainage as to turn the stream far out of its original course. Among mountains of recent growth, lake basins due to this cause have been found, and still other illustrations are found in basins that have been drained. Doubtless lakes of this sort developed in the course of the formation of the mountains of eastern New York; but this was so long ago, and has been succeeded by such a complex series of changes, that every evidence of their existence has been erased.

To form lakes by crustal movement does not necessarily call for the growth of a mountain chain; a gentle warping of the crust may cause a broad hollow. Also, with a stream sloping moderately in a given direction, let us suppose northward, an elevation or tilting of the land, slightly greater in the north than in the south, may transform the stream valley to a lake basin. It seems certain that such lakes as Champlain and the Great Lakes owe at least a part of their present basin form to such great crust movements, of which there is excellent evidence.

But by far the greater number of the thousands of lakes upon the surface of New York, and northeastern America in general, have come into existence as the result of glacial accidents. In

* Mather, Geol. Survey N. Y., 1st Dist., 1843, 32–37; 634–636; Dwight, A. J. S., 1866, 2nd Ser., XLI, 12–15.

numerous ways the ice has been responsible for lakes. For instance, when the ice was withdrawn from New York, it obstructed and dammed most of the north-flowing streams.* Since many of the New York streams are north-flowing, this caused the development of numerous temporary lakes held behind the ice dam. The evidence of these, in the form of shore lines and deltas clinging to the hillsides, is found in various parts of the State. Even in some of the south-flowing streams there is evidence of similar conditions; for, as in the case of the Alleghany, some streams that originally flowed northward, were held in the form of lakes for a long enough period to cut new channels at the outlet and thus reverse the streams. By far the most marked evidence of these glacial lakes is found around the shores of the Great Lakes, which were raised by ice dams until they covered large areas that are now dry land, and found outlets quite different from those at present occupied.

As the result of glacial *deposit*, scores of thousands of lakes have been caused in North America. Before the ice came, there existed valleys occupied by streams. These were then submerged by the ice and more or less completely filled with glacial deposit, so that, instead of retaining the original regular slope of the preglacial valleys, the drift-filled valleys were frequently irregular, with numerous basins. In these, lakes, ponds and swamps now exist.

There are many different kinds of lakes resulting from glacial deposit. In some cases morainic dams have been built across streams. Again the dams are drumlins, or eskers, or sandplains, or kames. For some reason of supply or inability to transport, a greater load is deposited in one place than in another, and then of course a dam results. There is an almost infinite variety of possibilities here, and even careful study in the field will not always discover the exact reason for such dams. To this class of lakes belong many of those that beautify the scenery of the Adirondacks † (Fig. 9).

As has been stated above (p. 2), in the irregularities of the glacial deposits themselves, which may be considered to constitute *new* land, numerous lakes of original consequent origin are found. The most abundant of these are the ponds in the morainic kettles (Fig. 10); but very often kettles in the stratified drift deposits—

* The consideration of these changes will be found in Article IV of this series, Bull. Amer. Geographical Soc., 1898, xxx, 206.

† In a paper just published, Kemp (Bull. 21, N. Y. State Museum) proves that Lake Placid is held in by a moraine dam, while other smaller lakes near by are in kettles in the moraine.

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the kames, sandplains and overwash plains—are also found occupied by such ponds. In these sections, however, there are more basins than lakes, for frequently the basins have so small a drainage area to

FIG. 9.—A GROUP OF GLACIAL LAKES IN THE ADIRONDACKS (S. R. STODDARD, PHOTOGRAPHER).

supply the water, or else are located upon so permeable a deposit of sand and gravel, into which the water sinks, that the basins cannot be filled to overflow (Fig. 10).

FIG. 10.—MARL BED OF A NEARLY DRIED-UP POND IN A KETTLE IN THE MORAINE NEAR CORTLAND, N. Y. (C. S. DOWNES, PHOTOGRAPHER.)

Another way in which the ice has been responsible for lake basins is by the erosive action of the glacier itself. Running water will maintain a fairly uniform slope, because it flows under the impulse of gravity; but rigid ice does not follow exactly the same

laws. Either where the rock is softer, or the erosive power of the ice greater, a glacier may locally excavate more rapidly than elsewhere, and thus form a lake basin due to glacial erosion. Of these basins numerous instances have been found among mountains and in Greenland, where they abound. Doubtless in the State of New York there are many basins which are either entirely or partly caused by this erosive action. It is my belief that the basins of Lakes Cayuga and Seneca, and probably also Ontario, are in part due to glacial erosion (see p. 12).

Specific Instances.—So little study has been given to the origin of New York lakes, that in most cases it is possible to make only such general statements as those above.

The Great Lakes, about which so much has been written, will serve as the topic for a future article of this series, so that for the present it will suffice to state that their origin is apparently complex. Pre-existing valleys have been dammed by glacial deposit, these valleys have in some cases been deepened by glacial erosion, and the lake form and depth have been essentially modified by the tilting of the land. This is quite generally agreed to be the origin of these lakes, although the relative importance of one or the other of these causes is not agreed upon.

Chautauqua Lake is very shallow and is considerably filled by stream deposits; its outflow at present is toward the south. The depth of the filling is not known; but, judging by the depth of the drift in other valleys in this section, it must be great. While it cannot be considered established, there is good topographic evidence in favor of the view that at least the northern end of the Chautauqua valley was in preglacial times tributary to the Lake Erie valley, the cause of the diversion being an extensive morainic deposit across this valley. There is a constriction of the valley near the middle of the lake, which suggests that this was the preglacial divide. If this view be true, Chautauqua Lake is made up of parts of two valleys, one north sloping, the other south sloping, and each dammed by heavy morainic accumulations.

In Central New York are a series of linear lakes, mostly located in north-sloping valleys. The two largest of these are Cayuga and Seneca. Each of these Finger Lakes owes its existence in part to glacial deposit, and, in the case of all but Cayuga and Seneca, this cause seems to be the important one for the basins. Without doubt they have all been modified by post-glacial uplift of the land, which was greater in the north than the south. Since this tilting is defi-

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nitely established, it may be considered proved that the form and depth of these lakes have been modified by this cause.

In the case of Lakes Seneca and Cayuga, however, evidence has been brought forward* to show that they are in large measure due to glacial erosion; and doubtless future studies will discover other instances in which the same conclusion will be reached with reference to some of the Adirondack Lakes and probably basins in other parts of the State. There has been a prejudice against glacial erosion as an efficient means for carving rock basins, due, no doubt, in part to the extravagant claims made for this agency by Ramsay and his followers. Some even ignore the evidence brought forward in support of this cause; but when the final word has been written concerning the operation of ice in the erosion of basins, I predict that rock basin formation will be given a much more prominent position than some glacial geologists at present believe.

Aside from the Finger Lakes and Ontario,† the only other case that I am aware of in which glacial erosion is claimed as the cause for a lake in New York, is that of Lake Mohonk in the Shawangunk Mountains which Darton‡ ascribes in part to glacial deposit and in part, and probably pre-eminently, to glacial erosion.

Very little has been published upon Lake Champlain, but its markedly linear form and irregular outline suggest that it, together with Lake George, furnishes another illustration of a river valley clogged by a drift deposit, and modified by land tilting. In all probability also, the free passage of ice down this valley scoured out the valley bottom so that the basin is in part due to ice erosion. Its irregular form is the result of the entrance of the ponded water into tributary valleys of pre-glacial origin, forming bays and straits where the valleys existed, and promontories, islands and isthmuses where the land was higher.

An interesting case of a lake connected with the withdrawal of the ice sheet is described by Quereau.§ While the ice was withdrawing from this part of the country, temporary rivers flowed from the waters that were ponded back by the ice dam, forming glacial lakes. These rivers carved channels in places where now no rivers flow, and such channels are recognized south of Syracuse near Jamesville, as well as elsewhere. In one of these channels James-

* See references, Bull. Amer. Geographical Soc., 1898, XXX, 396, in connection with which the question of origin of these lakes is also considered.

† Tarr, Bull. Amer. Geographical Soc., 1898, XXX, 53.

‡ State Museum Repts., Vol. 47, 1894, 540–552.

§ Bull. Geol. Soc. Amer., IX., 1898, 173–182.

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ville Lake exists, occupying a pothole carved out at the base of a waterfall whose existence ceased when the ice barrier permitted the temporary stream to select another and lower channel. This is probably one of a type, other instances of which may be expected to be discovered as a result of future study. If Niagara should disappear, such a lake would exist at the base of the Horseshoe Falls.

LIFE HISTORY OF LAKES.—Even a large lake has a brief history when considered from the standpoint of geological time. A lake serves as an obstruction to a river, and this obstruction interferes with the river development. For the time being the stream cannot, at any place above the lake, lower its bed distinctly below the lake surface, so that the river at once sets about to remove the obstruc-

FIG. 11.—INLET DELTA AT HEAD OF LAKE CAYUGA. CITY OF ITHACA SITUATED ON EAST SIDE OF DELTA.

tion, commencing work at both ends of the lake, lowering the channel of outflow at the outlet, and attempting to obliterate the lake by filling, transforming it to dry land.

Most lakes are destroyed by the combined work of cutting and filling, and this is the fate that awaits most of those in the world, even the largest. The main rivers, the thousands of tributaries, great and small, the temporary rainborn rills, the waves on the shore, and the wind from the land, are all at work carrying fragments of rock waste from the land to the lake. The contributions of a single day or a single year may not be great; but after centuries and scores of centuries, the cumulative effect of those minute contributions is felt.

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Naturally most of the rock waste is furnished by the largest streams, and of this the coarsest, and in fact the greatest measure, is deposited at the very mouth of the streams, forming deltas which constantly grow out into the lake, and will ultimately fill it in combination with the other agents of filling (Figs. 11 and 13). A large stream bearing sediment from one side may build a delta which temporarily bisects the lake (Fig. 12), or, as at Interlaken, in Switzerland, two such deltas from opposite sides may accomplish the same end. During the process of lake filling there may be a great variety of stages.

FIG. 13.—TEMPORARILY FLOODED WESTERN PORTION OF INLET DELTA AT HEAD OF CAYUGA LAKE, N. Y.

The ultimate end, therefore, is destruction by filling, provided no other processes of destruction enter to check this. It may happen, to be sure, that the outlet stream cuts away the barrier faster than the lake is filled, and then the waters are drained off from the deltas and even from the lake bottom. This mode of destruction will usually occur only where the outlet barrier is a soft deposit, such as glacial till, that is easily removed. Even then there must be considerable slope for the outlet stream. Usually such an outflow stream possesses little power of erosion, because most of the sediment has been filtered out by the lake waters, and the stream therefore emerges clear and free from the cutting tools

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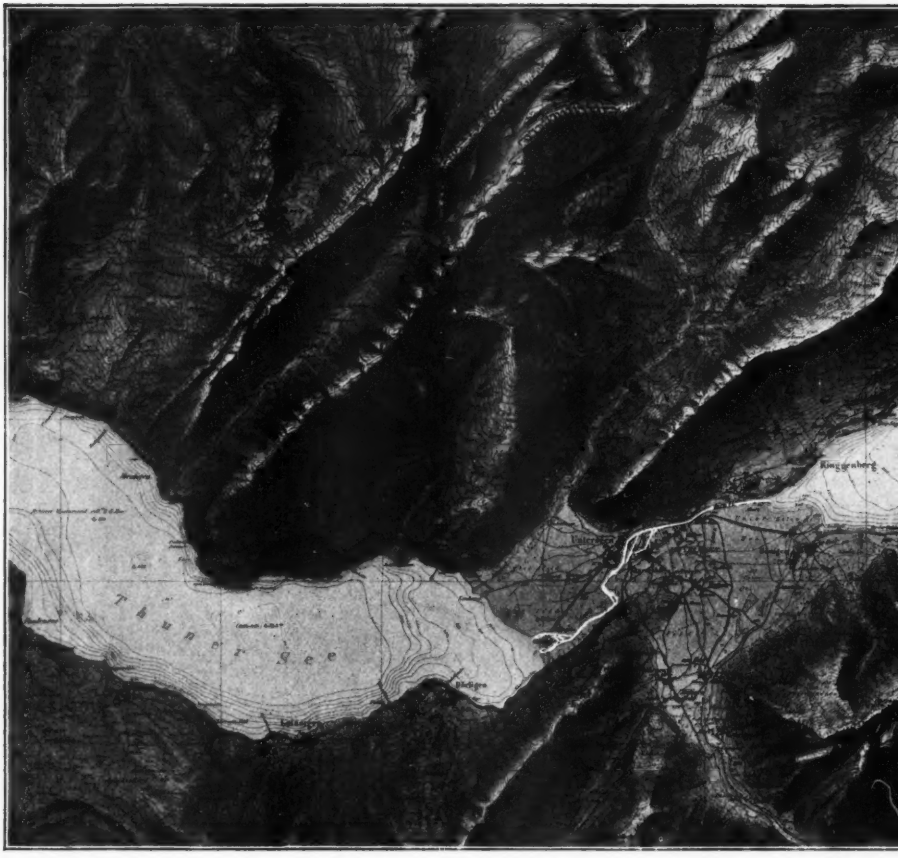

FIG. 12.—MAP OF VICINITY OF INTERLAKEN REGION, SHOWING BISECTION OF LAKE BY

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OF LAKE BY GROWTH OF DELTA (SWISS TOPOGRAPHIC MAP).

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with which most streams are enabled to scour out channels even in hard rock.

If for any reason the power of the outlet stream becomes sufficiently concentrated, even though it has little sediment, it may work effectually to lower the barrier. For instance, Niagara River, which is scarcely cutting at all in its channel above the cataract, is at work at the Falls at such a rate that they have already retreated several miles, and are each year moving nearer Lake Erie. If they could ever be able to reach the lake, there would then come a sudden drop in the lake level.

FIG. 14.—SWAMPY SHORE OF LONG LAKE, ADIRONDACKS (COPYRIGHT, 1888, BY S. R. STODDARD, GLENS FALLS, N. Y.).

With the filling of a lake, vegetation often has much to do (Figs. 14–19). As soon as the water in one place becomes shallow enough. lacustrine vegetation takes root and in time transforms this section to a swamp. The delta margins are among the first to become thus transformed.

For instance, at the southern or inlet ends of Lakes Cayuga and Seneca, as well as of some of the other Finger Lakes, extensive delta deposits have been accumulated from the waste obtained in the erosion of the post-glacial gorges. The depth of the delta-filling in some cases amounts to 200 or 300 feet, and the surface is

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nearly level, because it is primarily determined by the plane of the lake surface. These level tracts, reaching slightly above the water, are naturally swampy, particularly near the lake shore, and the same is true of some of the small deltas that are being built along the margin of these lakes opposite the gorges, as, for example, opposite Taughannock. These marginal delta swamps are not so extensive in Lake Cayuga as they are along the shores of Chautauqua Lake, because the depth of water to be filled is so much greater in Cayuga than in the shallow Chautauqua. Opposite the mouths of all the larger streams entering Chautauqua Lake there are broad and very swampy delta tracts.

FIG. 15.—SWAMPY SHORE OF FIFTH LAKE, FULTON CHAIN, ADIRONDACKS (S. R. STODDARD, PHOTOGRAPHER).

The delta plains near the head of Lakes Cayuga and Seneca are most swampy on the side where the sediment supply is least abundant, that is, on the western side in the case of Cayuga, and on the eastern side in the case of Seneca. This has had an important influence in determining the location of the two towns of Ithaca and Watkins (Figs. 11, 13 and 17).

Accumulation of rock débris in the lake will in time do more than form deltas opposite the stream mouths. It will eventually fill

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up the lake.* This filling is aided in its last stages by vegetation. The reeds, the lily pads, the sphagnum moss, and other water-loving plants, transform the shores to swamps, and finally may reach over the entire surface, forming a broad swamp in place of the lake (Fig. 19), at first not dry enough for trees, but later transformed to a tree-covered swamp. In these swamps peat is formed,† and there are thousands of filled ponds and lakes of this origin in the State.

In some cases, before the vegetable deposit is formed in excess,

FIG. 16.—SWAMPY SHORE OF CLAY POND, BOURNE, MASS. (J. L. GARDNER, 2ND PHOTOGRAPHER).

there are conditions favoring the accumulation of layers of animal remains. First sediment finds its way into the pond freely, then, the shores becoming swampy, the sediment is commonly arrested in its course near the margin, so that the shells of animals may accumulate more rapidly than either the rock fragments or the vegetable remains. In such a case layers of shells are formed, and

* Smyth, A. Geol., 1893, XI, 85–90.

† Mather, Geol. of New York, 1st Dist., 1843, 12–16, 229–32; Vanuxem, Same, 3rd Dist., 1842, 229–31.

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after this, with the encroachment of vegetation, plant remains accumulate in excess. In such places we find first a layer of clay, representing a time of deposit of sediment, then of animal remains, such as marl (Fig. 10) or infusorial earth (including the tests of diatoms), and above this is a bed of peat. Hundreds of sections similar to this have been revealed in various parts of New York, the best with which I am acquainted being those at the cement works at Casadaga Lake in Chautauqua County. Here the lakes are not entirely filled, but during the process of filling have been divided into several lakes and swamps, so that every stage in the lake destruction may be seen.

Such conditions as these are best found where the sediment supply is slight. In some places there is so little clay and sand furnished that the organic deposits are most prominent. For instance, some of the ponds occupying kettles in the moraine near Cortland have such a slight drainage area that they receive so little sediment that their beds are made exclusively of a marl (Fig. 10), which is so abundant that it is removed for use.

Elsewhere the lake filling is mainly accomplished by vegetation from first to last, because almost no sediment is supplied. This is illustrated in the case of ponds and swamps in the wooded region of the Adirondacks and in the tiny kettle ponds in parts of the moraine; but on a larger scale it is illustrated in the lakes and swamps of southern Florida, where the streams bring almost no sediment, and the lakes are being changed to swamps by an accumulation of vegetable muck which in places is several feet thick. Such deposits as these may be considered as embryonic coal beds.

Thus sediment filling, aided by plant and animal deposit, is engaged in the extermination of lakes, and the first result is the formation of swampy land. In this State there are instances of every stage of lake filling from the beginning to the end. Later the swamps will be drained by natural processes, for the streams are then able to flow across the deposits (Fig. 19), and thus help to drain and to excavate them, so that finally the swampy tracts are transformed to dry plains drained by the very streams that helped to form them. In time all the lake deposits will be removed from a valley, and this completes the life history of the lake. Of this process of removal of lake deposits there are instances in this State, though in most cases the time since the glacial period, when the lakes were formed, has been so brief that filling is generally incomplete.

Not all lakes pass through this normal cycle of development; some are subjected to accident by which they are removed. For

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instance, a lake held behind an ice dam will disappear, when, by melting, this dam is removed. Such has been the history of the ice-dammed lakes of New York. With so insecure a dam such lakes are very uncertain, as one may plainly see along the ice margin of Greenland, where in a single season lakes form and disappear.

Another cause for disappearance of lakes by other than the normal processes is when the climate changes from moist to dry. If, for example, the climate of the Great Lakes should change to one of aridity, they would gradually shrink until they were disconnected, and this shrinking might continue either until the basins became dry areas of interior drainage, or were occupied by shallow lakes, saline in character through the concentration of the salts furnished by the water, but no longer removed by overflow, and incapable of being removed by evaporation.

Such a condition as this exists in many arid lands, notably in Central Asia and our western interior basin, in which one of the basins holds the Great Salt Lake. While this condition is now absent from New York, the presence of extensive beds of Silurian salt suggests the possibility that, at this early period, the supposed conditions actually did exist within the confines of the State; and in the changes of climate which have occurred since then, of which we feel certain that there have been many, though we cannot specify each of them, and point out its effects, there may well have been similar changes in later periods; indeed others still may be in store.

Swamps.—There are various ways in which swamps may be formed; but perhaps the commonest swamp in New York is that caused where underground water escapes to the surface on a hillside, or at the base of a hill, and finds its run-off retarded, either by the growth of vegetation, or by the levelness of the ground. With the removal of the forests, many swamps of this kind have disappeared, and their site is marked by the presence of a dark carbonaceous soil. In other cases the supply of water is so great that the mere removal of trees is not sufficient to drain the surface; and then, in some instances, artificial drainage has been resorted to.

Swamps of this kind, although abundant, are small. They are found in great numbers in the morainic country, where the water readily percolates through the stratified drift, but is retarded, and even forced to escape to the air, when it reaches the more compact underlying boulder clay. Sometimes a linear swamp is then formed along a part of the base of a hill; or sometimes the water seeps out of the soil on a hillside, where, by a little excavation, a spring can

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be made. The swamp-loving vegetation, the sphagnum, etc., grows abundantly here, and spreads, finally causing a small hillside swamp. In the damp climate of Scotland and Ireland, the sphagnum bogs at times become so saturated with water that they commence to flow down the hillside, often causing considerable destruction.*

Long linear swamps are also formed in many places along the base of the beaches that were built when the waters of the Great Lakes stood at a higher level. The rain soaks down into the gravel, but is not able to so easily enter the underlying clays. Such swamps as these abound along the north faces of the beaches formed during the high stage of Lake Erie in Chautauqua County.

FIG. 17.—SWAMPY PORTION OF INLET DELTA, HEAD OF CAYUGA LAKE (C. S. DOWNES, PHOTOGRAPHER).

Swamps, often of a temporary nature, are formed on the floodplains of the New York rivers; but they are commonly dried up shortly after the river floods have subsided. Such swamps may be seen along the Upper Mohawk where that river is flowing over the level plain of the old lake bottom. These swamps, on a small scale, are the counterpart of the great swamps of large floodplains, like those of the Mississippi, the Yellow, etc.

Of the *large* fresh-water swamps, which are very abundant, the great majority are connected with some part of a lake history. For instance, a bay, either on sea or lake shore, becomes shut in by

* See Früh, Viertel. Naturfors. Gesells., Zürich, 1897, XLII, 202–237.

bars, and, upon being filled, is changed to a swamp. Or, even without an enclosing bar, a bay along a lake shore may become a fresh-water swamp by mere filling as the result of the sediment brought by tributary streams. The filling of any lake or pond will in time produce a swampy tract (Figs. 13–19). This process of lake filling, together with the production of delta, lake shore and filled-lake swamps, has already been sufficiently described.

Another class of lake swamps is that formed in connection with the disappearance of the ice. During the stand of the glacier, the

FIG. 18.—SWAMP REPLACING POND, CLAY POND, BOURNE, MASS. (J. L. GARDNER, 2ND, PHOTOGRAPHER.)

temporary lakes received deposits which were spread out with such levelness that swamps now exist on parts of the sites of many of them. Conewango swamp, in Chautauqua County, is situated in the bottom of an extinct lake, formed while the glacier was standing in that region. Although the lake has now disappeared, its presence is marked by shore lines on the neighboring hillsides.

The Montezuma marshes, at the outlet of Lake Cayuga, also appear to be associated in origin with the withdrawal of the ice sheet. One expects to find swamps at the *head* of lakes, where fill-

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ing is in operation ; but the *outlet* should not normally be the seat of an extensive swamp, as is the case in Lake Cayuga. It is known that the ice stood in this region for a while, building moraines and evidently pouring sediment into the lake from streams issuing from its front. This sediment, entering a body of quiet water, naturally spread itself out in the form of a moderately level sheet. This shallowed the northern end of Lake Cayuga, so that in post-glacial times it has become transformed to an extensive swamp, chiefly through the agency of vegetation, which has added the top layer.

FIG. 19.—VALLEY OF THE BOREAS, ILLUSTRATING SWAMP FORMED BY LAKE FILLING (COPYRIGHT, 1888, BY S. R. STODDARD, GLENS FALLS, N. Y.).

This swamp is even now encroaching southward upon the lake, which is shallow near the outlet end, where the clear lake water merges imperceptibly into the reed-covered swampy tract.

Gilbert* has brought forward evidence that the land in the Great Lakes region is still rising, tilting the land by raising it more in the north than in the south, and geological evidence points to the conclusion that it has been rising in the recent past. This tilting of the land has necessarily diminished the slope of north-

* Nat. Geog. Mag., 1897, VIII, 233–247; Eighteenth Ann. Rept. U. S. Geol. Survey, 1898, 595–647.

flowing streams, and should tend to increase the swampiness of the lake deltas on the southern end of the Finger Lakes. Concerning such tilting Shaler * has suggested that the swampiness of one of the New England valleys, the Nashua, has resulted from this tilting, and it is not improbable that some swamps in New York are of the same origin. The swampy tracts along portions of the Champlain shore may be due to this rising change in level of the land.

By far the most extensive swamps are those produced by the elevation of level sea bottoms. Drainage upon them is at first so poorly developed that they are swampy, as in the case of the elevated sea bottom of southern Florida and eastern Texas. Later, as the streams sink their channels into these level tracts, they become drained, as has been the case with the pine land plains of New Jersey.

There are no such sea-bottom swamp plains in New York, though during the elevation of the Appalachians, their western face, even in New York, was skirted by plains which at first were undoubtedly swampy, similar to those upon which the coal fields of Pennsylvania developed. These have now been transformed by elevation and dissection to the central New York plateau, from which many of the overlying layers have been stripped, so that it is not impossible that the evidence of this swampiness, in the form of coal beds, which may once have existed, has been removed in the course of denudation.

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* Amer. Jour. Sci., 1887, XXXIII, 210–221.

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HAWAIIAN ETHNOGRAPHY.

BY

TITUS MUNSON COAN.

The Hawaiians belong to a race that is remarkable for its unity in spite of a very wide dispersion. It is sometimes called the Maori race, but is best distinguished from other races of Oceanica, as the Micronesians, the Malaysians, the Papuans, and various Malay islanders, as the brown Polynesian. Its region is the central and eastward Pacific Ocean, whither the Maoris migrated, in all probability, from the Asiatic continent through Malaysia, making their first habitat the Samoan Islands; whence they spread as far as Hawaii in the north, and as far east as Easter Island in the southern Pacific, while their southward range extends to New Zealand. This ocean triangle of some 5,000 miles to a side includes about 15 groups or detached islands inhabited by the brown Polynesians: Hawaii, the Marquesas, Tahiti, Paumotu, Tonga, Rotuma, Samoa, New Zealand, the eastern Fijis, Tarawa, Manega, Tokelau, Phœnix and Lagoon Islands, and Easter Island.

Throughout this vast oceanic habitat, the "South Seas" in popular phrase, though it includes the northern group, Hawaii, the brown Polynesian is one. Both in physical type, in language, traditions, arts, usages, customs, he is everywhere substantially the same—or was before the obliterating hand of European civilization swept over the finely graven plate of Nature's etching. In briefly describing the Hawaiians as they were I shall try to restore the outlines of a portrait of which the leading features are common to all the groups. And it must be remembered that the modern Polynesian—the Polynesian since his discovery by white traders and voyagers—is a much vitiated type. The primitive peoples, before their debasing contact with white voyagers and traders, were greatly superior beings to those which traders and voyagers have described—a comparatively heroic race; and their vices, of which we hear so much, are in large part vices of modern introduction.

PHYSIQUE.—The Hawaiian men were tall and powerful, having an average stature of 5 feet 10 inches—the highest average, after the Patagonian Tehuelches, of any race that has been measured; and

their muscular strength also ranks among the highest records. The chiefs attained a still greater average of bulk and stature, being splendid giants often. The women were rather small, but exceedingly well formed. They had oval faces, expanded foreheads, dark brown or black hair, waving or curly, but never frizzled like the negro's, a somewhat flattened nose, full nostrils, large expressive eyes, a large mouth, and splendid teeth, with a pearly whiteness like the teeth of young dogs; while the sweetness and sensibility of their expression often atoned for the flattened features. Their personal comeliness, however, seldom lasted beyond youth, except in the case of the chiefs, who were kept in splendid condition by passive exercise,—the lomilomi, or Hawaiian shampooing; but their better feeding led often to enormous fatness—400 pounds being a not uncommon weight.

The Polynesian complexion is a soft brown, with a tinge of red or yellow in it. The skull has a minimum index of 75, placing it on the confines of the white type; it is never prognathous. Broca found among the Hawaiians the highest orbital index that he had ever observed.

Mental and Moral Traits.—The ancient Hawaiian was an amiable, pleasure-loving, and yet very intelligent and daring race, producing bold navigators and valiant warriors. During centuries of undisturbed residence in their group they had become perfectly fitted to their environment, and but for the cruel oppressions of their priests and their kings they would have been an ideally happy people. The priests harried them by their *tabus*, the kings by incessant wars; yet they reached a social concordance which we should look for in vain among more highly civilized communities, for the degrading struggle for the mere means of livelihood which is almost universal in populous countries was unknown throughout Polynesia. Why was it unknown? The studied restriction of the population, whether by limiting the number of births or by infanticide, kept the number of the people well within the limits of the food supply; and these practices, by exempting the survivors from the struggle for life, were, in my opinion, the secret of their material comfort and consequent mental and social development. In France the limitation of families to an average of a little over two children to a family has led to similar results—a great general diffusion of comfort and an amenity of manners that is unknown in more crowded communities. The natural indolence of the Hawaiians was thus not hurtful to them; it gave them leisure for games, poetry, and hospitality. It required

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but a few days' labor to supply them with taro, their food-staple, for a year; their skill in fishing, and the abundant wild fruits of the mountains supplied whatever more they desired, and they had the opportunity of developing a kindly culture to which it would be hard to find a parallel elsewhere, whether among primitive or civilized peoples.

They were a curious, eager, excitable people; great talkers, full of fire and gesticulation, yet docile and teachable to the last degree. They had no power of prevision; their intellectual hospitality indeed has only hastened their decay, for they accepted the good and the bad together from foreigners, and allowed themselves to be imposed on by all the destructive arts of tradesmen and adventurers. What with imported diseases and the infertility resulting from changed conditions, which is the main factor in their decrease, there are now, in Hawaii, but 33,000 left of a population estimated by Cook at 200,000.

LANGUAGE.—The language is a dialect of that which is spoken throughout the whole domain of the brown Polynesian. This wide diffusion of the same speech is very striking. Anywhere else in the world the mere passing of a boundary line shall bring you into the Babel of alien speech; but I have sailed 3,000 miles due south from Hawaii, and on stepping ashore at Aitutaki found no difficulty in talking with the natives in the Hawaiian tongue; and 2,500 miles farther the same tongue is spoken in Southern New Zealand.

Of this common language, the first noticeable feature is the great predominance of vowel sounds. In spoken Italian the ratio of vowel to consonantal sounds may be estimated about as two to three; in Hawaiian, as three to two, or somewhat more than twice as great. A word may be composed of three successive vowels, and in some of the Polynesian dialects even of four; and it is possible to construct sentences of some length in which not a single consonantal sound shall occur, as, for instance, this in Hawaiian: *E i ai oe ia ia e oo ia*—"Speak to him now that he may learn." The American missionaries reduced the language to writing, employing an alphabet of but 12 letters—a, e, i, o, u, h, k, l, m, n, p, w. The number of actual sounds in the language has never been studied, but it is probably at least twenty, as against about twice as many in English. Every syllable must end with a vowel, a restriction which, with that of the fewer sounds in the language, makes English pronunciation a hard thing for the Hawaiian; thus *Ka-mi-ka* is the nearest approach he can make to "Smith." The accent generally falls on the penult,

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but a certain number of words are distinguished from others only by the place of the accent, as *máno*, an immense number; *manó*, a shark. Nouns have no inflection; the pronouns have a dual as well as the singular and plural numbers. The comparative degree is formed by the juxtaposition of contraries, as "Peter is great, Paul is little." The verb has a full and complex conjugation, as in more than one primitive language. A remarkable circumstance is that the verbs *to have* and *to be* do not exist in the language. It should seem impossible to hold rational speech without making use of these auxiliaries; but the Hawaiians find no difficulty. We say, "That is a handsome woman;" the Hawaiian, *Wahine nani ia*—"handsome woman that." After a meal, instead of "I have eaten enough," they say, *Piha ke opu*—literally, "Full the belly."

Their vocabulary is rich in all the terms relating to life and nature. Thus, there are eight or ten words, according to special uses, for our verb *to break*. Thus, *hae-hae* is to rend the heart; *hai*, to break, as a bargain or covenant; *haki*, to break, as a stick of wood or other brittle thing; *kipo*, to break open, as a box; *moku*, to break, as a cord or chain, or as the neck of a victim; *naha*, to smash, as crockery; *poha*, to break, as thunder, as a torrent; *wawahi*, to break down, as a house. Their system of numeration was peculiar; decimal up to 40, but it progressed thereafter by decimal combinations of 40. For 70 the Hawaiian would say 40–20–10, as the Frenchman says 60–16. The numeration went by multiples of 40 as far as 400, for which there is a special word; and so on, with intervening partial numbers to 4,000, 40,000 and 400,000, each of these numbers having its special word. 400,000 was the limit of the notation, but higher numbers were not unmanageable; thus, for 864,895 they would say 2 *kini*, or 400,000; 1 *lehu* or 40,000, 6 *mano*, or 4,000; 2 *lau*, or 400; *umi*, or 10; and *elima*, 5. *Lima*, very curiously, is the Polynesians' word for hand, and the first four numerals, *akahi*, *elua*, *ekolu*, *aha*, are identified by some philologists with the corresponding words in the indo-European tongues; as if, at the remote time of their separation from the Aryan stock, the Maoris had learned to count four and no farther.

The language is deficient in abstract terms; and the missionaries, on translating their scriptures into the native tongue, found much embarrassment in giving equivalents for such terms as godliness and grace; while for virtue, in default of any equivalent term, the good men were driven into exposition and exegesis.

RELIGION.—The Hawaiians were devotedly religious, their system

being a mixed idol-worship and hero-worship. The divine powers, *akuas*, dispensed good and evil to men. They were omnipresent; they ranked according to their dignity as higher or lower, and were represented by images of phenomenal ugliness, made of wood, wicker-work or stone, ornamented with sharks' teeth or human hair. The shades of kings and great priests were also deified. Each island and each chief had its own gods; their temples or sanctuaries, *heiaus*, were walled enclosures of undressed stone. The largest of these, built by Kamehameha I, is still standing; it is 100 by 224 feet, with walls 22 feet high and 12 feet thick at the base. Within was an inner court and a shrine, and here were offered human and other sacrifices. The famous *tabu* was the great instrument of religious oppression—a system of prohibitions with cruel penalties, which weighed upon almost every act of the people's life, and especially upon the women. Even animals were brought under the terrible ban. When a strict tabu was in force, to win the favor of the gods, no fire or light was permitted upon an entire island; no sound was to be heard; the dogs were muzzled; the cocks and hens were hid away in calabashes; none but the priests were allowed to stir abroad; and the penalty for infraction of these devout observances was death. The entire system of tabus was abolished by Kamehameha before the arrival of the missionaries.

Social Usages.—The Hawaiians had a feudal system not unlike that of Germany in the eleventh century. A sharp distinction into three classes existed. First and highest were the *aliis*, or nobles, the king at the head; his councils were shared by the chiefs nearest the king, and by all his wives as well. The second class included the proprietors, so-called—for the kings had absolute right over both life and property; they paid regular taxes on the lands conceded to their use. The third class were the *roturiers*, or common people—small farmers, tenants, fishermen, builders, dancers, laborers; their property was liable to confiscation at any moment. The absolute despotism of the government was tempered only by the caprice or the humanity of the sovereign.

The domestic relations of the brown Polynesian, judged by European standards, left much to be desired. There were marriages, more or less permanent; wives, on suspicion, were sometimes subjected to cruel treatment, and the chiefs sometimes visited vengeance on the seducer; but the sentiment of chastity hardly existed, and the woman who refused herself was stigmatized as *pi*, or stingy. Polynesian hospitality to strangers, in the case of

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guests of rank equal to that of the entertainer, usually included the wife or daughter of the house; these favors being reciprocated when the entertainer returned the visit; and the Hawaiians were always fond of travelling.

ARTS.—The ancient Hawaiians understood enough of astronomy to make long voyages by observation of the stars; in the earlier centuries, at least, though not as recently as the time of Cook, it is reasonably certain that they sailed as far as Tahiti, some 2,000 miles to the south, and returned safely. Their houses showed less skill in the construction than the canoes of that time; they consisted of a wooden framework, thatched with grass, and were furnished with mats, beautifully woven in the better houses; but these slight buildings lasted only a few years at the longest. For wearing apparel they beat the inner bark of the *wauki*, or paper mulberry, into a fabric not unlike brown paper, which they stained in ornamental patterns in brilliant vegetable dyes. Their magnificent feather cloaks are too well known to need any description here.

In the fine arts, save that of poetry, all the Polynesians were deficient. They had no pictorial art, no written language; and yet they carried the epic poem to a high development, preserving their ancient history and the names and exploits of their heroes in long *mélés* or chants, both musical and metrical, according to their own canons; and these were transmitted from one generation to another by hereditary bards. In other *mélés* they recited at equal length the names, descriptions and attributes of plants, animals, places, the heavenly bodies, the *materia medica;* their whole *corpus scientiarum*, indeed, as well as *poetarum*, was reduced to rhythmic form, and so perpetuated until the advent of the trader and the missionary, to whom these things were vanity. A certain portion of the old poetry, however, has been preserved by the labors of Fornander and other scholars. Their music was very primitive; drums and a bamboo flute, which I remember having seen played by the nostrils, being the principal instrument in their rude orchestras. But the Hawaiian has great natural aptitude for the art, and makes a good performer of modern music.

The games of the ancient Hawaiians were many and interesting; in this province, indeed, he was an inventor; but a long paper would be needed to describe his *hula-hula* and other dances, his hill-sliding, his surf-playing, his spear-throwing, his *puhénehéne*, and the rest. These sports are now mostly disused, together with most of the old customs; some belief in the ancient gods still remains;

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but the native population is merging in the crossing waves of foreign blood, whether of white or yellow races. That most interesting of all aboriginal races continues to mingle with only too happy facility with the foreigner; the brown Polynesian is passing away by intermarriage; and the mixtures of the Hawaiian population will become one of the most complicated studies in the ethnology of the future.

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NOTES ON METEOROLOGY.

CLIMATE AND HYGIENE OF THE CONGO FREE STATE.—A recent publication on the climate, soil and hygiene of the Congo Free State (*Congrès National d'Hygiène et de Climatologie Médicale de la Belgique et du Congo, du 9 au 14 Août, 1897, 2me Partie, Bruxelles, 1898*) furnishes striking evidence of the rapid growth of our knowledge concerning portions of Africa that, within comparatively few years, were marked "Unexplored" on our maps. This volume comprises 890 pages, and will prove of the greatest value to those who wish to understand the physical and commercial conditions of the country of which it treats. Others, also, who have no particular interest in the Congo Free State itself, but who are anxious to know something concerning the conditions of life and health in a moist tropical climate, will find much valuable information in this report. Four hundred pages are devoted to the meteorology of the region, and contain fairly complete data from 65 stations. Twenty pages are concerned with the soil conditions, and the rest of the book is given up to an admirable discussion of the medical climatology. Probably that portion of the book which deals with the disease and death statistics, food and mode of living of the Europeans in the Congo Free State, will have the most interest for Americans just at the present time. As to the relative success of Europeans of different nationalities, it appears that, contrary to the usual rule, the northern peoples (Danes, Swedes, Norwegians) have succeeded better than those from the south (Italians). It should be said, however, in commenting upon this rather startling fact, that the Italians were engaged in the unhealthy occupation of railroad construction, while the Scandinavians were chiefly employed on board vessels on the river. Persons with nervous temperaments do not succeed well. The age at which it seems best for the European to begin his residence in the Congo Free State is between 25 and 35 years. White children born in the State should be brought up in Europe. The previous condition of health in the immigrant from northern latitudes is of great moment. Dyspeptics suffer severely in a tropical climate; heart troubles are aggravated; phthisical patients are frequently much benefited; alcoholism leads to many tropical disorders.

The necessity of a more or less frequent return from the enervating monotony of the tropics to the stimulating, changeable

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weather conditions of northern latitudes, is universally acknowledged. The length of time during which Europeans may remain in the tropics without serious harm varies according to the physical condition of the individual, his mode of living, etc. Under existing conditions, colonization, properly so called, meaning the permanent establishment of the white race, does not seem possible in western tropical Africa except in a few specially favored places.

It may be of interest to note here an opinion recently expressed by Colonel J. C. Gore, (British) Colonial Secretary of Sierra Leone (*Geographical Journal*, Dec., 1898, p. 606): "Acclimatization may be possible in other tropical countries, but West Africa is exceptional. * * * I attribute my escape from the effects of the climate to *great good fortune*, and, of course, being very careful in my living."

RAINFALL ON THE GREAT PLAINS.—The rainfall on the Great Plains is briefly discussed in the *Journal of School Geography* for January, 1899, by N. W. Fenneman. The problem is one of very considerable interest. This intermediate region, between a rainfall sufficiently large for successful agriculture on the east, and a rainfall too small for successful agriculture on the west, has been the scene of a pathetic struggle on the part of the farmers to make a living out of the soil, where nature seems to have decreed that there shall not permanently be enough rain to enable them to do so with profit. The sudden filling up of the so-called Rain Belt in western Nebraska and Kansas, and eastern Colorado, some years ago, and the subsequent depopulation of the region, when the conditions were not found to be suitable for farming, are well known in the history of our western country. Very graphic is the description given by Willard D. Johnson in the *National Geographic Magazine* for December last of the present conditions of the central portion of the Great Plains, known as the High Plains. Mr. Johnson says: "There are towns on the High Plains. At least, there were towns in the days of the great 'boom.' Of some of these there now remain neither population nor buildings; others show a scattering of buildings, though empty ones, and in a few, among many empty buildings, is to be found a family here and there. These vestiges of boom creation have been merely waiting for something that has never happened, that never can happen—the blossoming of the desert. At one time across the interspaces the farmer swarmed, but he, too, is gone, as a class. As in the towns, so on the great flats in between, of the flocks that once settled

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down and then took flight again, a lingering representative is still to be found here and there; and he is waiting for a change of climate, for the farm on the High Plains is nothing more than a body of land, surrounded by wire fence. It can never be anything else except as, in half a decade or so, sod finally heals the furrows of the futile plow and it goes back to prairie and cattle."

Climate of Puerto Rico.—Prof. Mark W. Harrington, whose name is well known to meteorologists the world over, is now on duty in Puerto Rico, engaged in organizing a section of the *Climate and Crop Service* of the United States Weather Bureau. The *Monthly Weather Review* for September (issued Nov. 22) contains a preliminary note, by Prof. Harrington, on the climate of Puerto Rico. The published observations are very scanty, indeed, consisting of a total of about nine years at San Juan only, and these are fragmentary, being scattered through twenty years. The mean temperature, according to the records, is 78.9°, with the small seasonal change characteristic of the tropics. February is the coldest month on the average, with a mean temperature of 75.7°, and June is the hottest, with 81.5°. The coldest month on record is January, 1895 (70.0°), and the warmest is June, 1878 (86.0°). The average change from the coldest to the hottest month is 6°. The minimum temperature on record at San Juan is 57.2°, in January, 1894, and the maximum is 100.8°, in May, 1878. At San Juan the year is divided into a wet and a dry season. The dry season, with a rainfall of 10 or 11 inches, embraces the months from December to March, and is the most attractive season, being relatively dry and cool. This is the proper season for the visits of northerners to San Juan. The climate is then mild and safe. The wet season includes the other eight months of the year, with a rainfall of 48 or 49 inches. The total annual rainfall is nearly 60 inches at San Juan. Rainy days are rare, however, the rain coming in the afternoon or evening, and there is no impression of a rainy climate, except that everything seems fresh and clean. Hurricanes occasionally visit the island during the hurricane season (August–September).

Meteorological Chart of the Great Lakes.—Within the past few years the Weather Bureau has given special attention to the study of the meteorological conditions of our Great Lakes, with a view to giving navigators of those waters all the information possible concerning the atmospheric conditions, storms, fog, currents, etc. The *Meteorological Chart of the Great Lakes*, issued Jan. 4,

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presents a summary for the year 1898. The relative frequency of fog during the season of navigation (April 1–December 15) is indicated by five different styles of shading, denoting respectively 0-10, 11-20, 21-30, 31-40, 41-50 days with fog. A "day with fog" means a day on which fog sufficiently dense to obscure objects distant 1,000 feet prevails for at least an hour. Fog was observed the greatest number of days (60 out of 259) in the region east of Keweenaw Point. The investigation of fog during the past season has established two important points. *First*, that fog reports from shore stations cannot be depended on to establish fog conditions on the Lakes, since fog was reported continuously on the Lakes while very little appeared at land stations. *Second*, that the wind direction appears to have but little influence on the formation of fog, especially on the Upper Lakes. During the season, 143 vessels were totally or partially lost. Of these, 39 were total losses, all being due to gales, and 104 were partial losses, 22 being due to fog and 82 to gales. The number of lives lost was 96.

ROBERT DE C. WARD.

PHYSIOGRAPHIC NOTES.

RECENT PAPERS ON NIAGARA.—The Niagara River continues to be a theme for investigation; and one of the most admirable studies upon this interesting problem is a recent paper by Taylor (Bull. Geol. Soc. Amer., IX., 1898, 59-84). After describing the gorge, and calling attention to the alternation of broad and narrow sections, he correlates them with variations in the outflow of the Great Lakes. Taylor believes that the time of formation of the Whirlpool Rapids section coincides with the period of overflow of the upper Great Lakes across the Nipissing pass and into the Ottawa River, by which Niagara was reduced to a tiny stream, draining merely the area of Lake Erie.

This influence of variation in water volume, first suggested by Gilbert, and later elaborated by Spencer, is now made still more definite by Taylor's discussion, in which he argues that, because of the diminished volume, the time required for the formation of this narrow section of the gorge was very much greater than would have been required at the present rate of retreat of Niagara Falls. This then lengthens the age of Niagara gorge to probably 50,000 years, though Taylor admits that it may have been as low as 35,000 years, as estimated by Spencer upon similar grounds.

While this paper of Taylor's must be considered in the future studies, his conclusion cannot at present take rank as more than an hypothesis. Already arguments have been brought against it, as, for instance, by Wright (Proc. Amer. Assoc. Adv. Sci. 1898, XXVII, 299-300), who shows that the lower part of the gorge is not much more weathered than the upper part, as one would expect if the lower portion is from 35,000 to 50,000 years older than the upper.

In the same volume with Taylor's paper is one by Upham (Bull. Geol. Soc. Amer., IX, 1898, 101-110), where the facts are stated in a similar way to those by Taylor, but with markedly less stress placed upon the time of overflow across the Nipissing pass. Moreover, instead of ascribing the narrow Whirlpool gorge to diminished water volume, Upham accepts Pohlman's idea that it really represents an interglacial or preglacial valley, which the modern Niagara very rapidly swept clear of drift. Upon the basis of this argument Upham reaches the common conclusion that the age of the gorge is from 5,000 to 10,000 years.

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So the longer the investigation of Niagara continues, the less clearly we seem to approach a definite result; and we must for the present believe that Niagara River is not a good chronometer. It is possible that future investigations will clear up some of the difficulties, but the present aspect is far from encouraging.

FIFTEENTH ANNUAL REPORT OF NEW YORK GEOLOGICAL SURVEY.—The State Geological Survey of New York has contributed very little to our knowledge of the physiography of the State. This is well illustrated in the last annual volume (Fifteenth Annual, 1897, 738 pp.), a rather ponderous book, with unnecessarily wide margins, but with splendid paper and typography. The lack of appreciation of physiographic features is indicated by the fact that the geology of the State is still treated in large part upon the old-fashioned method of county divisions. Geologic and physiographic problems do not end at county boundaries.

As a contribution to the stratigraphic and economic geology of the State this report of course takes prominent rank; but the physiographer will find little to interest him, notwithstanding the richness of the opportunity.

THE PALISADES AND THE TRAPS OF NEW JERSEY.—By way of contrast, reference may be made to the reports of the Geological Survey of the neighboring State of New Jersey, which has published Salisbury's admirable report on the Physical Geography of the State. Also in the last Annual Report (for 1897, pp. 23-150) there is a valuable physiographic contribution by Kümmel, who describes the geology of the Red Sandstone belt of Triassic, or Newark, age—a series of beds of sandy rock which were apparently deposited in shallow estuaries that were subsiding as the sediment accumulated.

Into these beds sheets of basaltic lava were *intruded*, as, for instance, at the Palisades, where the lavas have a width of from 700 to 875 feet. In other places, as in the region near Paterson, the lava was *poured out* in the form of surface flows. These outflows occurred late in the Newark time, and the intrusions seem to have come somewhat later still.

There occurred an elevation after this volcanic period, and accompanying it the rocks were slightly folded and considerably faulted, which caused a certain measure of tilting. After this period of uplift, there was a long time of denudation, which Kümmel believes to have culminated in the development of a peneplain. By a later uplift and dissection, the harder rocks have been etched into relief, so that they now stand above the region in the form of hills.

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The Report contains many interesting points of geology and physiography in addition to those mentioned here.

RECENT STUDIES OF ATOLLS.—A great deal of interest is attached to the investigations that are being carried on by English geologists concerning the true origin of the isolated coral atolls of the open ocean. For instance, Bonney (Nature, Vol. 59, 1898, p. 29) announces that the boring at Funafuti has reached a depth of 987 feet and is still in limestone. However, according to Agassiz (Amer. Journ. Sci., CLVI, 1898, 165-167), the borings now being made are not likely to definitely settle the question of the origin of these islands, as has been hoped. In his studies in the Fiji Islands, Agassiz finds *elevated* reefs of limestone of late Tertiary age, and states that the coral reef itself forms only a relatively thin crust upon a platform of submarine erosion. This being the case, borings made through the coral and into the older limestone may fail to reveal the real differences that exist, so that, by including the Tertiary limestone, it may be assumed that there has been a recent subsidence of very much greater extent than has really occurred.

FRANZ JOSEF LAND.—In the Quarterly Journal of the Geological Society (Vol. LIV, pp 620-645), Dr. Kœttlitz discusses the geology of Franz Joseph Land, and calls attention to some interesting physiographic features. He finds raised beaches to a height at least 400 feet above the sea, and drift wood and whale bones at levels of 90 to 100 feet, while the entire skeleton of a seal was discovered at a height of between 300 and 400 feet.

The sedimentary rocks of the land are Jurassic, and they are in many places covered with basaltic lava flows, which Dr. Kœttlitz assigns to Jurassic instead of Tertiary age, as has been supposed. Over much of the land, as is well known, there are glaciers, the covering of ice being so thin, however, that the rocks frequently protrude.

LAKE CHELAN, WASHINGTON.—Gannett (Nat. Geog. Mag., IX, 1898, 417-428) has given us a description of the very interesting and beautiful Lake Chelan, in Washington, which is tributary to the Columbia. This lake is from 50 to 60 miles long, with a width of from one-half to one mile, or a little more in places. The walls of the valley rise at an angle of from 40° to 45°, directly out of the water, reaching an elevation of from 4,000 to 5,000 feet above the lake, which has a depth of 1,400 feet, reaching 300 feet below sea level. There is evidence that the valley has been occupied by a

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deep glacier at least 100 miles long, and Gannett explains the lake as the result of a terminal moraine dam. While there is doubtless evidence of the existence of such a dam *at the surface*, it seems at this distance exceedingly improbable that there has been accumulated a morainic dam 1,400 feet in height. It would be distinctly unusual, and a lake of this nature would seem to be more probably due to ice erosion than to mere damming. Another possible origin is that of dam folding or faulting, and both of these must be eliminated before the moraine dam explanation can be accepted.

THE CINCINNATI ARCH.—It has been quite customary to consider the broad dome of the Cincinnati arch in the Ohio valley as representative of an ancient Silurian island. Miller (Amer. Geol. XXII, 1898, 78-85) argues against this current assumption, and ascribes the conditions in that region, not to lack of deposit, because of land conditions during the Silurian, but to later denudation, and concludes that the Silurian island must henceforth "take rank as a geological myth."

R. S. TARR.

THE RUINED CITY OF COPAN.

BY

GEORGE BYRON GORDON.

The exploits of Cortes and the conquest of Mexico, rendered into popular literature by Prescott, are chiefly responsible for the common belief that north of the Isthmus of Panama the high-water mark of pre-Columbian civilization on the American continent was that reached by the Aztecs. It is true that at the time of the conquest the Aztecs were the dominant race; they were then at the height of their power and glory, and their influence was more extended than that of any other nation. It is not intended to detract from the brilliancy of the Aztec civilization, as set forth in the testimony of eye-witnesses at the time of the conquest; but, compared with that of another civilization that had already passed away, it was as the brightness of the full meridian moon to the splendor of the sun that has already set. Nor is it claimed that the Aztec culture was a borrowed culture. That is a matter involving vast differences of opinion; and it is characteristic that while so much ingenuity has been wasted in vain speculation, so little has been accomplished by actual investigation that it is still a matter of dispute whether the Maya culture was developed on the soil where its remains are found or brought with the people from parts unknown; whether the Aztecs borrowed from the Mayas, or the Mayas from the Aztecs, or whether both these great nations derived their culture from the Toltecs. And again, it is claimed that the Toltecs themselves are nothing more than the figures of a sun-myth.

The two great aboriginal civilizations of the North American continent that furnish us with material for investigation and study are those of the Aztecs and the Mayas. The relationship between them is not clearly defined, but it is noteworthy that these two peoples, having an entirely separate political existence, differing radically in language and customs, had legends which appear to have had a community of origin in some indefinitely remote past.

At the time of the conquest there was a remnant of a population on the peninsula of Yucatan,—a number of tribes who still haunted the vicinity of the deserted cities,—and these are generally believed to have been the descendants of the builders, though this is by no means certain. They called themselves Maya people; their lan-

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guage, they said, was Mayathan, the Maya speech; and their ancient capital they called Mayapan, which means literally the Maya banner, and in this connection means the Maya capital. This was the first acquaintance of Europeans with the name Maya. At the present day the name is applied generically to all the affiliated tribes speaking dialects derived from the same ancient stock as the Maya proper, and specifically to that ancient civilization the remains of which are found scattered over Yucatan and Central America.

Notwithstanding the many ingenious theories that have been advanced to explain their existence, we are almost as much in the dark concerning the Mayas to-day as we ever were. The student who seeks a knowledge of their history and all that pertains to it, even in the light of the most recent investigations, is like a voyager on an unknown coast, who sees from the deck the broken outline of an unfamiliar land, with a bold headland here and there a lofty peak, while all beyond is doubt and mystery.

The picture that is presented to the mind of the student by the name Maya is that of a mysterious race emerging from the unknown, and playing their part on the checker-board of nations until the hand of fate sweeps them back into the darkness from which they emerged, and the only evidence we have that they ever existed consists in the relics of their art and industry that lie buried in the soil of their ancient empire.

The field offers splendid opportunities for discovery, but until the general interest of those who have it in their power to promote the cause of American exploration is more fully aroused the history of the Mayas must remain what it is, a sealed volume, whose title suggests a world of tempting possibilities. American archæology is yet in its infancy. While so much has been done to throw light on the ancient civilizations of the East; while the pyramids have given up their dead, and been made to tell the secret of the ages; while Baalbec has been born; while Babylon and Nineveh are born again, and Priam's city on the plain has seen again the long forgotten sun,—Palenque and Copan have been allowed to continue their slumber of oblivion. Indeed, it is not so very long since the very existence of prehistoric monuments on the American continent was denied. And yet the tropical jungles of America hide the ruins of capitals not less wonderful than famed Palmyra or the City of the Sun.

If we enquire into the reason for this comparative indifference to American ruins, it is partly to be found in their apparently irrela-

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tive character, in their irrelevancy to the great drama of history as it is known to us. They have no place in the tide of traditional and legendary lore, the art and literature, the myth and poetry that is the common inheritance of European nations. No surviving civilization has inherited anything from the Maya civilization, and so Palenque and Copan cannot excite the same feelings as ancient Tyre or Dido's city by the sea; yet this very isolation gives to American ruins a character that is absolutely unique, and creates for them an interest that is peculiar and apart. They present a spectacle that is unparalleled in the history of the world. In complete isolation, shut off from all knowledge of other civilizations, the Mayas reached by themselves a high state of culture, and approached in a surprising degree the condition of the highest civilizations of antiquity.

Another reason why they have not attracted more attention is that they are hidden in the wilds or among the mountains of untravelled and unexplored regions, buried in dense forest and difficult of access. From the valley of Mexico, the centre of its power and influence, the Aztec civilization had at the time of the conquest spread itself to the Gulf of Mexico and to the Pacific Ocean, from the River Panuco in the north to the Gulf of Tehuantepec in the south, with small outlying colonies still farther south. The broad plains of Yucatan and the fertile valleys of Central America comprise the theatre where the much older Maya civilization had its rise, culmination and decline. It is on this peninsula of Yucatan that the Maya power seems to have reached its ultimate development, and it is here that their ruined cities are most numerous. The principal ruins known to us to-day are those of Chichen, Labna, Mitla and Uxmal in Yucatan, Palenque and Ococingo in Chiapas, Tikal, Menche and Quirigua in Guatemala, and Copan on the western frontier of Honduras.

Copan, then, is the name by which one of the most remarkable of these ruined cities is known to us, and it is for the presentation of some of the most remarkable features of this ruined city that I ask your attention for the space of an hour. Whether or not this was the name by which it was known to its ancient inhabitants we do not know, but when we examine the etymology of the word, its appropriateness suggests a probability in its favor. The substantive *pan* in the Maya language means primarily "banner," but when applied to a city as a part of its name it was equivalent to "capital." Thus as Mayapan was the capital of Maya, so Copan would mean the capital of Co, a name, however, that appears on no

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written record known to us. And while Copan belongs to the same ancient civilization as Palenque in Chiapas, the two were not necessarily contemporaneous. It is more probable that Copan was the former home of the people who founded the later Maya empire in Yucatan and Chiapas. Co may have been the ancestor of Maya. Hidden away among the mountains of Honduras in a beautiful valley, which even in that little travelled country is unusually secluded, it stands as a monument to the extraordinary enterprise and ambition of its rulers. The existence of this lost city was first made known to the world in 1840 by Stephens and Catherwood, who gave a description in the "Incidents of Travel in Central America," but their account was received by many with skepticism and mistrust, and the temporary interest which was then awakened was not revived until 1885, when Mr. A. P. Maudslay, of London, made the first survey of the ruins and presented the South Kensington Museum with a set of casts and photographs of the principal monuments. In 1890, the Peabody Museum at Harvard University began a series of explorations among the ruins that have been followed by very gratifying results, and it is hoped that these explorations may be renewed in the near future.

The only roads leading to the ruins are rough mule trails over the mountains, which are often impassable, and over these we had to transport on pack mules, from the coast, all our supplies and apparatus. The distance by the roundabout trail can be covered on a good mule in five days, but the native muleteers in charge of the pack trains can easily occupy three weeks in making the journey.

Stephens, the discoverer, states that at the time of his visit in 1839 the whole valley was buried in deep forest, the abode of monkeys and jaguars. To-day there are no monkeys in the vicinity, and the dark, gloomy forest where they like to roam is wanting. This forest was cut down about thirty years ago by a colony from Guatemala, who came to plant in the fertile lands of the valley the tobacco for which, much more than for the ruins, that valley is celebrated throughout Central America to-day. They left the trees that grew upon the higher structures, making a picturesque grove, a few cedars and ceibas of gigantic proportions, clustered round the ruins of the temple, shrouding them in a sombre shade and sending their huge roots into the crevices and unexplored chambers, vaults and galleries of the vast edifices.

The area occupied by the ruins of the city consists of a level plain about eight miles in length and two miles wide at the great-

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est, shut in by mountains that rise in ridges to a height of three thousand feet. The Copan River enters through a gorge to the east, and, after winding through the plain, disappears through a gorge to the west. The whole of this plain is covered with the remains of stone structures, probably the dwellings of the upper classes. The streets, squares and courtyards were paved with stone or with a white mortar cement, made from lime and powdered rock; and the drainage was accomplished by means of covered canals and underground sewers. Around the outskirts of the city and along the foothills of the mountains are seen numerous stone foundations, which probably supported the wooden houses of the people. On the slopes of the mountains surrounding the valley, and even on the tops of the highest peaks, fallen columns and ruined structures may be seen.

On the right bank of the river, in the midst of the city, stands the principal group of structures—the temples, palaces and buildings of a public character. These form part of what has been called for want of a better name the Main Structure, a vast irregular pile, rising from the plain in steps and terraces of masonry and terminating in several great pyramidal elevations, each topped by the remains of a temple, which, before our excavations were begun, looked like a huge pile of fragments bound together by the roots of trees; while the slopes of the pyramids and the terraces and pavements below are strewn with the ruins of these superb edifices. This huge structure, unlike the great pyramids of Egypt and other ancient works of a similar character, is not the embodiment of a definite idea, built in accordance with a preconceived plan and for a specific purpose. It is rather the complex result of a long process of development, corresponding to the growth of culture, and keeping pace with the expanding tastes of the people or the demands of their national life. Its sides face the four cardinal points; its greatest length from north to south is about eight hundred feet, and from east to west it measured originally nearly as much; but a part of the eastern side has been carried away by the swift current of the river, which flows directly against it. The interior construction, where it is exposed by the action of the current, presents to view fragments of walls and floors down to the water's edge. There seems to be layer upon layer of older ruins far beneath the foundations of those now occupying the surface, and if these are ancient, what must be said of those that are at the bottom of it all?

In the midst of the Main Structure, at an elevation of sixty feet, is a court one hundred and twenty feet square, which, with its sur-

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rounding architecture must have presented a magnificent spectacle when it was entire. It was entered from the south through a passage thirty feet in width between two high pyramidal foundations, each supporting a temple. A thick wall pierced in the centre by a gateway, now stripped of its adornments and in ruins, guarded this passage to the south. The court itself is enclosed by ranges of steps or seats rising to a height of twenty feet, as in an amphitheatre; they are built of great blocks of stone neatly cut and regularly laid without mortar. In the centre of the western side is a stairway projecting a few feet into the court and leading to a broad terrace above the range of seats, and guarded at either end by the figure of a rampant jaguar. The upper steps in this stairway are divided in the midst by the head of a huge dragon facing the court, and holding in his distended jaws a grotesque human head of colossal proportions. To the north of the court stood the two magnificent temples, 21 and 22, which are among the most interesting yet explored, and which may be taken as types of this class of building. Only the lower walls of these buildings remain standing, but the enormous quantities of stone removed during the excavation show that they must have had several stories, while the number of sculptures bear witness to their elaborate adornment. From the stone-paved terrace above the northern side of the court a great stairway, with massive steps, leads up to a platform that runs the whole length of temple 22, and is carried out upon solid piers to the line of beginning of the steps. From the head of the stairway two graceful wing stones, extending across the platform, guard the approach to the first entrance which gives access to the outer chambers. The doorway was nine feet wide and was covered by a vaulted roof now fallen. Directly opposite it in the interior is a second doorway leading to the inner chambers. A step two feet high runs in front of the entrance, with a row of hieroglyphs below; at either end a huge death's head forms a pedestal for a crouching human figure supporting the head of a dragon whose body is turned upward and is lost in the scrollwork of a cornice that runs above the entrance. The blocks of stone forming the arch had fallen when the place was cleared, and it seems probable that they had been supported by wooden lintel and door jambs which had entirely disappeared. Among the ruins of this temple were found a great many heads and busts which must have adorned its fallen facades. All the interior walls were covered with a thin coat of stucco, on which figures and scenes were painted in various colors, and interior cornices were adorned with stucco figures and

other ornaments, likewise painted. Nearly all this painted plaster and stucco, of course, was fallen, and found only in fragments. All that remains of this building was literally buried in a mass of broken sculptures with which it had been adorned.

Another feature of the main structure is the western court, which is on the same level as the eastern. Its broken pavement is strewn with sculptures fallen from the high temples 11 and 26. Here rises the double stairway leading to the entrance of temple 26, of which only the foundation remains. This stairway is adorned with rows of colossal skulls or death's heads, which give the place an extraordinary air of solemnity and gloom. Here also stands the great altar or table Q, with its procession of priests carved on the four sides and an inscription on top. To the north of the main structure the great plaza, paved with stone and cement, stretches away to the north and terminates in an amphitheatre about three hundred feet square, enclosed on the eastern, northern and western sides by ranges of seats twenty feet high. The southern side is open, except that its centre is occupied by a pyramid that rose almost to a point, leaving a square platform on top. In the plaza stood the principal group of obelisks, monoliths or stelæ, as they are variously designated, to which Copan owes its principal fame. There are fifteen in all scattered over the plaza, some overthrown and others still erect. On the northern wing of the main structure rises the hieroglyphic stairway, one of the most important features that our excavations brought to light. From the cemented floor of the plaza it rose to the entrance of the temple above, of which not one stone remained upon another. The upper part of the stairway itself was thrown from its place as if by an earthquake and lay strewn upon the lower portion, and the whole structure is in a sad state of ruin. When discovered the stairway was buried beneath the débris fallen from the temple. The upper portion of the stairway itself had been thrown from its place and lay strewn upon the lower portion, and the whole was covered with a thick growth of trees. The width of the structure was thirty feet; each step is carved along its entire length by a row of hieroglyphs. The centre of the lower steps is occupied by a throne or pedestal, and at intervals in the ascent a figure of noble and commanding appearance, arrayed in splendid attire, was seated on the steps. On either side is a solid balustrade, all elaborately carved with symbolical devices, and supporting a number of portrait-like busts which are held in the jaws of some grotesque monster.

At twenty feet in front of the stairway stands an obelisk twelve

feet high, having a full-length figure on the front and a hieroglyphic inscription on the back.

We come now to the monoliths, or stelæ. There are 27 in all scattered over the ruins, some overthrown and broken and some still standing. Although they have infinite variety in detail these monuments are in general design alike. In the front of each monument stands a human figure in high relief; the hands are held in front of the breast in an attitude that is common to them all; the nose is broken off, but it was probably prominent and aquiline; the mouth is open so as to show the teeth; the ears are shown in a conventional way; the hair is pushed back from the forehead and hangs in braids at either side of the head; the headdress is made up of folds or plaits of some stiff material, and at each corner of it appears a dragon's head. There is a breastplate with a dragon's head holding a grotesque monster in his jaws at either end. Next comes a broad girdle, with a row of tassels at the bottom and decorated with panels and with a medallion face in front and another over either hip. An apron hangs from the belt to the ground; there are garters on the legs and sandals on the feet. Above the head is a grotesque mask, with a double scroll terminating the carving at the top. The figures are all disproportionately short, and the artist seems to have been more bent on displaying the adornment than on making a good job of his figure. Some of the smaller figures found are accurately drawn.

The back of each stela, and the sides not occupied by the figure, has usually a hieroglyphic inscription.

That the Mayas were a literary people is shown by the fact that they possessed, among other concomitants of civilization, a highly developed system of writing, a system which was their peculiar property, and in these characters they carved upon the walls of their temples and on their monuments inscriptions that may contain the key to their history, if we could only read them. But there is no Champollion and no Rosetta stone, and yet something has been accomplished towards their interpretation: for although no living man can read a single inscription, the results of recent investigation are encouraging; and although we may never arrive at a full and accurate knowledge of the system of writing, we will surely in time be able to glean the general drift of the meaning of these inscriptions. Until very recently the veil of mystery that hung over these inscriptions was absolutely impenetrable, and it is only now that anything definite has been discovered in regard to their meaning.

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These results relate entirely to the Maya chronological system, and their methods of computing time, and they enable us to read the dates on these inscriptions in Maya chronology. The Maya calendar scheme, though elaborate, was altogether admirable and perfect. Through it we are brought in contact with the Maya genius, a genius which, in utter isolation, reduced the year to perfect reckoning and mapped the courses of the planets. The basis of the annual calendar was the solar year of 365 days, and every fourth year was a bissextile or leap year. The year was divided into eighteen months of twenty days each, with one short month of five days at the end. Each of the twenty days of the month had its name, and these names we know, together with the names of the months themselves.

This, in brief, was the basis of the annual calendar. But when the Mayas dealt with extended periods of time they adopted another system, the basis of which was not the solar year, but a period of 360 days, called the *ahau*. The *ahau* was divided into eighteen months or *chuens* or periods of twenty days. Twenty *ahaus* made a *katun*, and twenty *katuns* made a cycle, and thirteen cycles made a great cycle. The cycle thus embraced four hundred years, and the great cycle fifty-two hundred years.

Among the numerous objects doing service as decorative features on temples, stelæ and altars, the two most conspicuous are the serpent and the bird, and a combination of the two—the feathered serpent. The trail of this grotesque and monstrous creation is over every city and every temple, and wherever he is met with his main features are the same.

No regular burying-place has yet been found at Copan, but a number of isolated tombs have been explored. The location of these was strange and unexpected—beneath the pavement of courtyards and under the foundations of houses. They consist of small chambers of very excellent masonry, roofed sometimes by means of the corbelled arch, and sometimes by means of slabs of stone, resting on the top of the vertical walls. In these tombs one, and sometimes two, interments had been made. The bodies had been laid at full length upon the floor. The cerements had long since mouldered away, and the skeletons themselves were in a crumbling condition, and gave little knowledge of the physical characteristics of the people; but one fact of surpassing interest came to light concerning their private lives, namely the custom of adorning the front teeth with gems inlaid in the enamel, and by filing. Although not all of the sets of teeth found had been treated in this way,

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there were enough to show that the practice was general, at least among the upper classes, for all the tombs opened, from their associations with prominent houses, seem to have belonged to people of rank or fortune. The stone used in the inlaying was a bright green jadeite. A circular cavity about one-sixteenth of an inch in diameter was drilled in the enamel of each of the two front teeth of the upper row, and inlaid with a little disk of jadeite, cut to a perfect fit, and secured by means of a bright-red cement.

Besides the human remains, each tomb contained a number of earthenware vessels of great beauty and excellence of workmanship, some of them painted with figures in various colors, and others finished with a peculiar polish resembling a glaze. Some of these vessels contained charcoal and ashes, in others were various articles of use and adornment. The beads, ear-ornaments, medallions and a variety of other ornaments, usually of jadeite, exhibit an extraordinary degree of skill in the art of cutting and polishing stones, while the pearls and trinkets carved from shell must have been obtained by trade or by journeys to the coast. In the same tombs with these ornaments were frequently found such objects of utility as knives and spear-heads of flint and obsidian, and stone hatchets and chisels. These were doubtless family vaults, though none of them contained the remains of many burials.

As to the antiquity of Copan, although we have no data that will enable us to fix a date, there are certain historical facts that remove it from the reach of history or tradition, and place the era of its destruction long anterior to the discovery of America.

In 1524 Alvarado subdued the tribes in the province of Guatemala, and founded the city of that name. From this as a centre the dominion of the Spanish arms was gradually extended over all of Central America, and intercourse opened with settlements already established.

What was the condition of Copan at this time? Surely such a centre of wealth and power, with all its barbaric splendor and extended influence, had it still existed, would not have escaped the ambitious enterprise of the conquerors. According to custom, the exploits of boasting generals and the zeal of missionaries ought to have spread its fame through the length and breadth of the Spanish dominions. All that we find, however, in the written records of that time is a brief mention of an expedition sent in 1530 from Guatemala, under the leadership of Hernando de Chaves, who conquered an Indian stronghold called Copan, situated somewhere in this region; but from the brief and ambiguous account given, it is

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evident that the place, in strength and importance, must have been insignificant compared with the city of antiquity, the ruins of which are called Copan to-day, and concerning which history and tradition are silent.

Moreover, Hernando Cortes, during his march from Mexico to Honduras in 1525, must have passed within a few days' journey of Copan; yet neither he nor any of his companions makes any mention of such a place, though several of them give detailed accounts of the journey. Would the conqueror of Mexico have turned aside when such a prize was in his way?

Furthermore, in 1576 Don Diego Garcia de Palacio, an officer of the King of Spain, journeying from Guatemala to San Pedro, passed through the ruins, and in a letter to Philip II—a letter that is still preserved in the British Museum—describes what he saw there. His description is such as might be written to-day by any intelligent traveller; the buildings were in complete ruin, and the Indians who lived in the vicinity were unable to give him any enlightenment concerning them. Yet this was only forty-six years after the expedition of Chaves.

There is but one reasonable conclusion: the city was abandoned and in ruins long before the arrival of the Spaniards; all tradition concerning it was lost, and its name forgotten. Its glory was never beheld by Europeans. Could we conceive of that privilege as having been theirs, what would have been their astonishment when, issuing from the rocky passes and dangerous defiles of the cordilleras, they first beheld the vision of this enchanted valley with its guardian city. Standing in such a situation, and gazing on that scene in its present aspect, clothed in the melancholy charm of the wilderness, I was filled with admiration at the consciousness of what must have been, from the beauty of the situation and the barbaric grandeur of its architecture, the effect of that proud city in its prime.

The moral effect of all these ruins on the traveller who sojourns among them is not easily described. They have an atmosphere that is not shared by any other ruins in the world. The silence of the tomb pervades them. The solemn and sympathetic shade of the forest wraps them, like the sacred dead, as in a shroud of living verdure, where clinging moss and ferns, as though in pity, seem to hide what time has worn away. The impression they make is one of fallen power and grandeur, and while they may not convey the same feeling of majestic and eternal strength as some of the Old World ruins, they possess a beauty and solemnity that has stood the

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ravages of time and speaks in no uncertain terms of fallen pride and power and glory, the baffled dreams and hopes and plans of an utterly unknown and nameless people. But while the eye is captivated by their melancholy charm, the imagination is often pained by the unavailing effort to penetrate the hidden mystery, an effort that becomes a necessity through the tormenting curiosity they excite.

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RECORD OF GEOGRAPHICAL PROGRESS.

AMERICA.

TOPOGRAPHIC SURVEY OF NEW YORK.—The topographic survey and mapping of New York State is making fair progress. The State is co-operating with the United States Geological Survey in producing this map, and thus far seventy-three of the atlas sheets have been published. The sheets cover almost all of the eastern tier of counties, but only the Brooklyn sheet of Long Island is yet ready. The survey has also been extended through most of the Mohawk valley and to Niagara Falls, with a break in Wayne and Cayuga counties. The Ithaca, Elmira and Olean sheets are all that are yet issued for the south-central and south-western parts of the State. The sheets now ready for the public cover a little more than a third of the total area.

THE TRANS-ANDINE RAILROAD.—At least three German maps of 1898 show the trans-continental railroad between Buenos Aires and Valparaiso as though it were completed. It is not yet completed, however, and is not likely to be for some years to come. According to Mr. E. A. Fitz Gerald, the road has been advanced on the Chilian side of the Andes up to the mountains and on the Argentine side some distance into them; but in March last, forty-four miles of the most difficult part of the road remained to be built and further progress will necessarily be very slow. The part yet to built includes a tunnel under the Cumbre Pass, the summit of which is 12,795 feet above the sea. The road through the mountains is 3⅓ feet gauge, with rack and pinion for the steeper grades. Even greater difficulties are involved than had to be overcome in building the lines into the Peruvian mountains. Trains are now running as far as Punta de las Vacas in the Argentine mountains and to Salto del Soldado on the Chilian side.

ASIA.

RAILROADS IN CHINA.—About 360 miles of railroad are now in operation in China. The road from Tientsin, the port of Pekin, to Mongolia now extends from Tong-ku, at the mouth of the Peiho, north-east to Shan-hai-kwan, where it crosses the Great Wall of China, penetrates thirty miles further north into the edge of Mongolia and is still building. The part of the line now in operation is

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210 miles long. To the north of Tientsin extends the road, 80 miles long to Pekin, which has been carrying passengers and freight for over a year. It is doing an excellent business, is already one of the most profitable short railroads in the world and its capacity is being increased by the laying of another track. The first section of the important railroad which is to extend from Pekin to Hankau has been completed from the capital as far as Paoting-fu, about eighty miles. This completes the list of lines in operation. They are all owned by the Government and were constructed by Chinese labor under the direction of English engineers. The cars are of the American type and the locomotives on the Pekin and the Paoting road came from this country. Among the projected lines the most important at present is the Eastern Chinese Railroad, which Russia secured permission to build across Mongolia from the Trans-Siberian railroad to Vladivostock. It will be about 800 miles long, and expensive to build because that part of the country is very rugged. The surveys are far advanced and the road will be completed in a few years. The railroad now in operation beyond Shanhai-kwan will be extended to meet this road.

The Route to Pekin.—Major A. C. Tate describes (Scot. Geog. Mag., Dec., 1888) the present method of getting to Pekin. Shanghai is the starting place for passengers bound there. The journey may be made from Yokohama, but the Japanese vessels stop at ports of Corea and the journey takes ten days and is not popular among passengers, for that reason and also because the boats are all freighters and do not give comfortable accommodations to tourists. The Shanghai vessels advertise to sail for Tientsin on certain days, but do not start until they are full of cargo, which may be one to three days after the advertised time. Three companies engage in the Shanghai-Tientsin trade. Their vessels are all cargo boats, the passengers being merely incidentals. The vessels stop at Chifu on the Gulf of Pechili to discharge cargo and, if a strong north-easter is blowing, this work may be delayed. It takes anywhere from three days to a week to reach Tientsin. As the mouth of the Peiho has been so impeded with silt for three years that vessels of considerable draught cannot enter it, freight is discharged on lighters which are towed up to Tientsin and passengers are taken off on a tug to the train that carries them to Tientsin. By paying double first-class fare European passengers have the privilege of travelling on the mail train to Pekin. No Chinese passengers either of high or low degree are carried on this train. The mail train covers the distance

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between Tientsin and Pekin, 80 miles, in four hours if it runs on schedule time, which it often fails to do. The Pekin terminus is four miles from the city and this last stage of the journey is made in a car over one of the worst roads imaginable.

AFRICA.

WHITE POTATOES IN AFRICA.—*Le Mouvement Géographique* says that some years ago a few bags of white potatoes were sent from the Canary Islands to Matadi on the lower Congo. M. Paternot was just starting for the far upper Congo, 1,800 miles from Matadi, and he put four of these potatoes in his baggage. He excited the hilarity of his friends when he told them he was going to raise the much-prized tuber in Central Africa. When he reached Wabundu, on one of the Congo's head-streams, he planted his potatoes. Fifteen months later they already had an abundant posterity. Four harvests have been gathered. Many of the tubers were large, and grew from six to a dozen in a hill. At last accounts, Paternot's potato patch covered several acres, and he had sent plenty of seed to Tanganyika and other points for starting other potato farms. M. Emile Laurent, professor in a Belgian school of agriculture, who has returned from the Congo, is authority for the statement that the potatoes raised by M. Paternot are a little more watery than European potatoes, but not so much so as to impair their quality to an important degree. These potatoes are raised in the most elevated part of the Congo basin, and probably would not thrive at lower altitudes.

EXTERMINATING THE AFRICAN ELEPHANT.—The famous French composer, Camille Saint-Saëns, recently wrote a letter to the chairman of a meeting, held in Paris, to consider means for the protection of the African elephant. In this letter, he said:

"These animals, indispensable to real African civilization, are being rapidly exterminated for the sole purpose of enriching a few persons, who care for nothing except to put money in their pockets. All this slaughter to make billiard-balls and paper-cutters!"

He urged the need of appealing to the French authorities to protect the elephant in the French Congo and the Congo Free State. The desire to preserve this noble animal from extermination cannot be too heartily applauded, but at the same time the appeal of M. Saint-Saëns does not seem to be based upon an exact knowledge of the situation. The statistics of the Antwerp ivory market, now the greatest ivory market of the world, show that

fully three-fourths of the ivory now coming to Europe is what is known as dead ivory; in other words, the tusks, which have been accumulating in the hands of the natives for scores of years. Live ivory, or the tusks of freshly killed animals, furnishes only a comparatively small part of the supply, and it is not accurate to say that an enormous number of elephants are now being killed for their ivory. No doubt, white hunters in Africa kill elephants whenever they have a chance, but the highly prized opportunity is not of frequent occurrence. Dr. Donaldson Smith, a keen sportsman, killed only six elephants during his year and a half in the unhunted plains of Gallaland. It is, indeed, true that the elephant is disappearing before the progress of territorial occupation, but this is always true of all large game. Fifty years ago, the Transvaal was one of the great game countries, but it has now completely lost its most distinctive zoological features. Its tens of thousands of antelopes, rhinoceroses and leopards have all disappeared. The African elephant has also retreated before the advance of the white man to the north of the Zambezi, just as in India he has practically deserted the peninsula and taken to the Himalaya foothills. The Germans are already beginning to regulate the chase of the elephant in East Africa with a view to his preservation, and there is, as yet, no reason for believing that elephants are becoming fewer in the Congo basin.

Transportation on the Upper Congo.—*Le Mouvement Géographique* says that early in January a tugboat and two barges were shipped from Antwerp in sections, and will be put together at Stanley Pool. The tugboat is 80 feet long and draws 3½ feet. The barges are of steel, 175 feet long, 20 feet wide, and gauge 500 tons each. They are to bring ivory, rubber, coffee, cacao, copal, and other products from the factories and plantations of the upper river to the railroad. The tug, with both barges in tow, will make six round trips a year from the Pool to Stanley Falls on the Congo, or to Lusambo on the Sankuru affluent. They will carry annually about 6,000 tons of products about 1,000 miles down the river. It is expected that in the coming season about 15,000 tons of the products of the upper Congo will be brought down the river and shipped to Antwerp, Havre, Liverpool and Hamburg. Before the building of the railroad it would have cost $250 to carry each ton on the backs of men 235 miles around the Congo cataracts.

POLAR REGIONS.

The Andrée Search Expedition.—Herr Stadling, command-

ing the Andrée Search Expedition, reports the details of his proceedings down to November 29th, 1898.

Writing from Balkur, in the Lena delta, Herr Stadling announces that valuable botanical collections have been obtained by Dr. Nilson. He is also of the opinion that if a railway from the upper Lena to the great Siberian railway be constructed, it would develop a trade in the supplying of fish to the industrial and mining districts to the south.

No trace of Andrée or his balloon had been discovered.

MR. BORCHGREVINK'S EXPEDITION.—A telegram from Hobart, Tasmania, of December 19th, announces the departure for the south of the *Southern Cross*, with Mr. Borchgrevink's Antarctic Expedition.

GENERAL.

MEASURING A DEGREE OF LATITUDE IN SPITZBERGEN.—A Swedish-Russian expedition selected in Spitzbergen, last summer, the region where the measurement of a degree of latitude is to be carried out, and chose sites for the stations to be occupied during the observations. At a meeting in Stockholm in December last, it was decided to make a measurement next year, and the expedition will spend the winter of 1899–1900 in Spitzbergen. Astronomical observation being involved in the work, it is necessary, in the polar regions, to carry on operations in the late fall, winter or early spring, when the stars are visible. The fact is generally known, of course, that the object of such work as this is to obtain additional data for a more exact determination of the shape of the earth. French measurements in the last century in Lapland, France and Equatorial South America, demonstrated the slight lengthening of degrees of latitude, as distance is attained from the Equator, and thus proved incontestably that the earth is not spherical in form. It is, however, only by the combination of a large number of observations, and the comparison of many astronomical with geodetic results, that it is hoped to eliminate error as far as possible from the determination of the shape of the earth. All the preliminary arrangements for the Spitzbergen expedition have been completed. The scene of its work is far north of the places of similar measurements thus far accomplished.

WAKE ISLAND.—The second Philippines expedition landed on July 4 last on the isolated little rock in the Pacific, Wake Island, 19° 25′ N. Lat., 166° 25′ E. Long., and the Government has since

directed the formal taking possession of the island. Wake Island was discovered by the Spanish sailor Mendaña in 1568, when he was sailing northeast from the Solomon group. We are indebted to the Germans for the only map yet published, which shows what the three little islands, of which Wake Island is the largest, really are. Most maps merely indicate their position by a dot. The map is by Mr. R. Kausch, who, it is said, procured his material from the crew of the German bark *Libelle*, which was wrecked on the reef of the east coast of Wake Island in 1866. The map is reproduced by Mr. Paul Langhans in his "Deutscher Kolonial-Atlas." This map shows two peninsulas branching from the main body of the island, one extending north-northwest and the other northwest. From the head of the island to the end of the longer peninsula the distance is about six miles, and to the end of the short peninsula about five miles. The main body of the island is about three miles long and two miles wide at its broadest part. The peninsulas are each about a mile wide, narrowing towards the ends; and beyond each end is an unnamed island, one two miles long and the other a little shorter. The entire group is surrounded by a coral reef. In the water enclosed by the reef and peninsulas there is a depth of 26¼ feet, which shallows towards the south; and outside the reef there is anchorage in about 200 feet of water. A straight line between the island of Hawaii and Wake Island, if projected further west, passes about 200 miles to the north of the Philippines. There is no doubt of the availability of this uninhabited group either for a coaling or a cable station.

A LETTER FROM M. LOUIS VOSSION, French Consul at Honolulu, appears in the *Comptes Rendus* of the Paris Geographical Society, for Aug.–Nov., 1898, pp. 372–375.

M. Vossion writes that on the 23d of May he was told that a Tahitian vessel had arrived in distress at Hookena, South Kona District, Hawaii. As soon as the vessel reached Honolulu the Consul went on board and heard the following story:

> The vessel, a schooner of 32 tons, was the *Tetautua*. She left Papeete on the 26th of February, with eight persons on board—the captain, four sailors, the supercargo, and two passengers (man and wife). The passengers were to be landed at Penrhyn (Tongarewa) island. On the 2d of March a storm destroyed the compass and drove the vessel out of her course, and for eighty-one days she drifted. Food was abundant, but the water gave out. There were frequent rains, however, and water enough was caught in sails; but the people were worn out when they finally reached Hawaii.

The Consul adds that this modern instance confirms the well-

known traditions of the Hawaiians, and brings up the question of air and ocean currents between the Society group and the Hawaiian Islands.

He refers to a paper on the Currents of the Pacific read in July last, at Sydney, by Capt. Hepwarth, of the steamer *Aorangi*, belonging to the Canadian-Australian line. According to his experience, the currents vary with the season. He constructed, from thousands of observations made in 64 voyages (between Sydney and Vancouver, by Wellington, N. Z., and the Fiji Islands), twelve charts of the ocean currents, one for each month of the year, and each chart shows important variations.

Coaling Stations.—Steamships carry three-fourths of the world's commerce, and this carrying power and all the power used by nations for the defense of commerce depends upon coal. This is the reason Great Britain has secured so many coaling stations along all the great trade routes. Coal may be bought by any naval vessel and the merchant marine in time of peace at most of the ports of the world, but not at all of them. It is kept as a commodity at 231 ports of the world outside of Europe, where every port is a coal depot. According to Perthes's Sea-Atlas, outside of Europe, coal is specially kept for sale to steamers at eight ports of the north coast of Africa; thirteen ports of West Africa; fourteen ports on the Gulf of Mexico and Caribbean Sea; twenty-four ports of the West Indies; twenty-two Atlantic ports of North America; five Atlantic islands; nine ports of East Africa; eighteen ports of South Asia; six islands of the Indian Ocean; twenty-six ports of the East Indies and Philippines; fourteen ports of the East Asian coast; five ports of Japan, Sakhalin and Kamchatka; ten ports of Australia; seven ports of New Zealand; nineteen ports of the West coast of North America; ten ports on the west of South America; Honolulu and Hilo in the north Pacific; and at four islands in the South Pacific.

Definitions of Isotherms.—American text books of geography all give practically the same definition of isotherms, *i. e.* that they are lines drawn through places having an equal average of temperature. This definition is a part but not the whole of the truth, and most boys and girls leave school with a misconception as to what an isotherm is, and they rarely find out in later years. They all know that latitude and altitude are the main factors in determining the mean temperature of a place, but they do not know that isothermic maps take into account only one of these elements, and that is lati-

tude. They eliminate the influence of altitude. The isotherm passing over the top of Pike's Peak does not show the mean temperature at the summit of the mountain, but what the mean temperature would be in that immediate neighborhood if the land instead of rising high above the sea stood at the level of Coney Island.

The reason may be easily explained. Most of the inhabited land does not rise so high above the sea that the temperature is greatly affected by altitude. The effects on temperature of both altitude and latitude cannot well be shown on one map; and isothermic maps were devised to show the effects of latitude and some other elements, such as position near the sea or in the far interior. An isothermic line, therefore, does not show the actual mean temperature of a place on it unless that place is at sea level. But it is easy to deduce from the isotherm the actual mean temperature of the place if we know its elevation above the sea. How this is done is very clearly explained by Dr. H. R. Mill, as follows:

"The air grows cooler by 1° F. for every 270 feet of elevation above sea level, but isothermic lines show the sea level temperature. In using isothermic maps we must therefore remember that places 600 feet above the sea level have a temperature 2° lower than the isotherms indicate; places 6,000 feet above the sea 22° lower; those 12,000 feet above the sea 45° lower, and the mountain slopes 18,000 feet above the sea no less than 66° lower than the sea level temperature shown by the isotherms. This accounts for the fact that none of the important towns in the temperate zones is situated more than 2,000 feet above the sea, while in the tropics they are built at as great elevations as 8,000 or 10,000 feet."

Weather charts are an exception to this rule. They record the actual thermometrical readings at the points of observation.—(Condensed from the New York *Sun*, Jan. 1, 1899).

Death of Gen. Annenkoff.—Gen. Annenkoff died in Russia on Jan. 24. He will be remembered as the builder of the first railroad through hundreds of miles of sand waste when the project for connecting the Caspian with the upper Oxus was carried out. He succeeded Gen. Tchernaieff in charge of this enterprise. The latter had condemned the undertaking, declaring that the road could not be built without enclosing the track by a wall so high that drifting sand could not bury it. Annenkoff solved the problem of drifting sand by planting along the track hundreds of thousands of desert shrubs whose roots and branches helped to keep the sand in place; by sewing grass seed along stretches of the track where it was possible

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to pipe water and irrigate the surface adjacent to the roadbed; and by strengthening his embankments with the branches of desert shrubs placed in layers throughout the heaped-up earth, and covering their sides with layers of clay. He solved the water problem by piping it to the track from the mountains of northern Persia and the Murghab and Tejend rivers, and beyond Merv he relied upon subterranean supplies. Along parts of the road it may always be necessary to fight sand with a force of shovellers as is done to-day, but Annenkoff reduced the problem to manageable compass. His plans for building the Trans-Siberian railroad are those which are now being carried out, and in recent years he largely shaped and directed this great enterprise.

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NOTES ON ANTHROPOLOGY.

POPULATION AND ENVIRONMENT IN WESTERN MASSACHUSETTS.—The influence of environment on the human race is, in its varied aspects, one of the most fascinating and at the same time most elusive of the many problems of Anthropology. That man has been influenced in his development by his physical, climatic and social surroundings is well nigh indisputable; but the relative importance of environment as opposed to heredity, or the specific effect of a given environment, can be stated as yet only in general terms. Savage and barbarous peoples offer a vast opportunity for research in this line, but the results so far secured must be largely increased before that section of the science of Anthropology which bears the rather cumbrous title of "Anthropogeography" can become as definite in its hypotheses as some of its sister sections.

But while the environmental relations of uncivilized peoples demand, and are now securing, careful investigation, we must not overlook the fact that the relations to environment of those peoples occupying the highest positions in the scale of culture are equally worthy of study. The growth and distribution of population, the relative proportions of the sexes, the physical and mental characteristics of the people, their arts and industries, methods of transportation and communication; all these and many more may be studied in relation to their surroundings among civilized as well as among uncivilized peoples. In the case of civilized peoples the problem is somewhat more complicated inasmuch as the conditions of modern life are exceedingly complex, and environment becomes less and less important with increase of culture. We have in addition to be constantly on our guard lest we attribute to environment effects traceable in whole or in part to economic causes. Railroads, for example, introduce an artificial condition, which influences to a very considerable degree the population along the line of the road, but in most cases the railroad is itself strictly dependent on the topography of the region, and may to that extent be regarded as part of the environment.

That portion of Massachusetts which lies west of the Connecticut River affords a particularly good opportunity for investigations of the sort suggested, and I propose here to consider a few of the points referred to, in so far as they apply to this area. The subject is one for the exhaustive consideration of which a careful

study of the history of individual towns, and a thorough knowledge of local conditions would be required, as well as extensive personal knowledge of the region and its inhabitants. To this I can lay no claim; the results here presented being suggested by a personal examination of a small part of the area, and supplemented by the census reports and county histories. Some statements may seem so self-evident as to be unworthy of mention; but although it may be apparent to every one that the population of a lowland area, with good soil and facility of communication must be greater normally than that of a bare, bleak upland where intercommunication is more difficult, yet the extent to which this is true, and the consequences of the inequality are by no means so clearly recognized.

Physiographically the region may be described as consisting of a central Upland area, bounded on the east and west by Lowlands. The central area, generally known by the name of the Berkshire Hills, is a portion of the Cretaceous Peneplain of New England, and is a region of rather broad rolling uplands and long even-topped ridges, intersected by deep valleys such as those of the Deerfield, Westfield and Farmington Rivers. The sky-lines obtained from the peneplain level (which rises in a gentle slope from south-east to north-west) are remarkably even and perfect, there being but few monadnocks, and these few surmounting the general level by only about 200–300 feet. The minor streams of the area have excavated valleys often of considerable depth and extent, but the proportion of upland still remaining intact is very large. On the east this Upland is defined by the Lowland of the Connecticut valley; the fall-off to the lowland being in places quite abrupt, and the contrast between the two areas very marked, the lowland being exceedingly flat except where interrupted by the trap ridges of Mt. Tom, etc. The western edge of the Upland is, especially in its southern portion, very strongly marked by the abrupt escarpment by which it falls off into the Lowland of the Housatonic Valley; in the northern part the contrast between the broad flat valley excavated in the limestones and the rolling upland is less apparent, by reason of the interruption of the valley-lowland by the mass of Greylock.

The population of the area may be divided into two portions: a lowland and an upland. It is impossible to make any strictly accurate division on these lines for various reasons, as, for instance, the fact that many towns are partly upland and partly lowland, in character, but making the division as fairly as possible, it results that there are 41 upland and 30 lowland towns. Assuming this division

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to be fairly accurate, let us compare the population of the Upland with that of the Lowland.

In 1800 the population of the two contrasted areas shows a considerable preponderance in favor of the Upland, although the density of population was very much greater in the Lowland as its area is not a third as great as that of the Upland. By 1830 the population of the Lowland as an aggregate had caught up with that of the Upland, and passed it; by 1860 it was nearly twice as large, and in 1895 it was practically five times that of the region which a century before had equalled and surpassed it.* Considered by itself, the Lowland population doubled in the sixty years between 1800 and 1860, and increased over 124% in the thirty-five years from 1860–1895. Compare with this steady and rapid growth the experience of the Upland. From 1800–1860 the aggregate population of this area increased barely 4%, in contrast to the Lowland's gain of 100%; while in the period between 1860 and 1895 the Upland decreased 15%, as opposed to the increase in the Lowland of over 124%. If, instead of dealing with aggregates, we compare individual towns, the difference is still startling. The comparison is made somewhat difficult by the fact that there are so few towns in the lowland area which are not on the line of some railroad;—but if we select Cheshire, Egremont and Richmond as the most representative Lowland towns, and compare them with Peru, Leyden and Tolland which are typical Upland towns, it appears that whereas the former increased on the whole from 1800–1870 and have only recently begun to decline seriously, the latter have steadily and surely decreased from the beginning to the present till, in the case of Peru, the population to-day is but little more than one-fifth of what it was a hundred years ago. Some even of the larger Lowland towns which are on a railroad, like Hatfield, Bernardston and Deerfield, attained their maximum population between 1860–1870, and have since decreased as steadily as those other Lowland towns which are far from railroads. We have here probably to deal with the strong tendency toward urban life which the population of the State as a whole has manifested in the last thirty years. The smaller towns are deserted for the larger;—but although the Lowland and

	1800.	*1830.*	*1860.*	*1895.*
* Lowland.....	34,826	44,304	74,796	168,018
(No. per sq. m.)..	86	100	166	373
Upland.....	40,031	40,811	41,621	34,325
(No. per sq. m.)..	25	25	26	21

the Upland have suffered alike in this, the Upland has lost to a much greater degree.

The tremendous contrast between the Upland and the Lowland is shown with perhaps greater clearness by an examination of the dates at which the towns reached their maximum population. Of the 41 towns in the Upland, 16 attained their maximum population by 1810 or before, and have decreased (in a few cases with temporary gains) from that time to the present; while 13 more reached their highest between 1810 and 1850. It was to be expected that the population of the Upland would tend to move down into the Lowland to secure better advantages; but that nearly 40% of the towns should have reached their maximum a century ago, and over 70% before 1850 shows this tendency to be very strong, even though the greater part of the gain of the Lowland may have been due to the influx of settlers and laborers from outside. The similar statistics for the Lowlands show how great the contrast is. Of these towns 15 out of 30, or 50%, reached their maximum in the period from 1880–1895, and 75% since 1850. Or to put it more simply,—in the Upland nearly three-fourths of the towns reached their maximum *previous* to 1850, the majority in the earlier part of the period; in the Lowland, on the other hand, three-fourths of the towns attained their maximum *since* 1850, and the majority of them in the latter portion of the period.

Striking though these figures are, one must needs have seen the two regions to fully appreciate what the bare statistics mean. In the Lowland, as a rule, there is an air of prosperity; the farms are well cared for; houses are in fairly good repair, and there are but few of them abandoned. In the Upland, on the other hand, the general appearance is that of poverty and hard times; the houses are many of them abandoned, and many others, though still inhabited, are far advanced on the road to ruin. In some of the Upland towns the number of abandoned houses is very large*; they are to be seen everywhere along the roads; and off the roads, far back in the woods, are old cellars or orchards long since grown up to woodland, which testify to the fact that this abandonment of farms and houses has been going on now for a considerable period.

But from these mere outlines of the difference in the growth of the population of the two regions, I must pass to the consideration of another topic,—that of the proportion of the sexes, in connection with which there are some points of considerable interest.

(*To be continued.*)

* 25% in the case of Tolland.

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An interesting example of the tendency to produce the same arts under the same environment is that given in a recent book of travel in Northern Spain*. It is here stated that in the town of Riaño, where during the winter there is a heavy fall of snow, a sort of snow-shoe is made and used by the peasants. These shoes are known as "Barahones," and are made of two curved pieces of board, twelve to fourteen inches long, joined by two or three cross-pieces, upon which the foot rests, and to which it is attached by means of thongs wound round the ankle. As represented in the sketch which accompanies their description, the shoes are rather broadly oval, and could be used only, it seems, in the same manner as the Indian snow-shoe is used, *i. e.* by raising the foot and allowing the heel of the shoe to drag, as opposed to the sliding motion adopted with the Norwegian "Ski." These shoes were in use only in the town of Riaño, in Leon, and by the Pasiegos, near Santander; outside of these two places the name itself was unknown. This is the only instance which has come to my notice of the use of snow-shoes in Southern Europe, and the only case of a shoe similar in principle to the American Indian shoe outside of America. It would be interesting to trace up this isolated example of snow-shoes in Southern Europe, and discover whether it was really a native idea or had been borrowed, and if so, from whom.

ROLAND B. DIXON.

* In Northern Spain. H. Gadow. London. 1898.

WASHINGTON LETTER.

WASHINGTON, D. C., FEBRUARY 15, 1898.

APPROPRIATION BILLS.—Beyond the temporary interest aroused by the unprecedented cold and snow blockade the chief topics of geographic and scientific concern are those tied up with the belated appropriation bills now before Congress. The Sundry Civil bill still before the House contains the usual items for surveys and examinations; with a few increases demanded by the new possessions. It is hoped that facilities will be afforded for mapping Porto Rico and possibly making a beginning in Cuba. For the Philippines little is expected, beyond reports to be prepared by the commissioners, appointed by executive order, or the reports of army officers and civilian associates, detailed as has been Dr. George F. Becker, the geologist now at or near Manila. Only 15 days remain before the expiration of the 55th Congress, and nearly all the great measures of national importance are in apparently chaotic condition. Some of these, like the Nicaragua Canal bill, may be placed as "riders" upon the Sundry Civil or River and Harbor bill and thus be forced through in spite of opposition.

COMMERCIAL GEOGRAPHY.—Almost unknown to the geographers of the country there has arisen a geographical exhibit which, conducted on business principles, has reached a surprising growth and development. This is the Philadelphia Commercial Museum, at present occupying the spacious buildings on Fourth street, Philadelphia, formerly used by the Pennsylvania Railroad as its general offices. The rooms are crowded with exhibits arranged by countries, and by manufacturers showing the goods manufactured in other countries than our own and exported to countries where our own goods come in competition; that is, there are shown not only the products and arts of, for example, Mexico, but also the goods which are now being made in England, Germany, and other European countries and sold in the Mexican market. The importance of such an exhibit can be shown by a single instance. A Connecticut manufacturer of cutting tools wishes to extend his trade to Australia. He must know the quality, shape, and price of the goods now selling in the markets there. At the Museum he can see samples of these with the prices and can ascertain all the technical points, say, of the various sheep shears preferred in Australia.

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The Museum exhibit is, however, only the foundation for the work of the Institution. Based largely upon these, various lines of work have been taken up for giving specific information accurately and quickly. It is not sufficient for the merchant to know what were the conditions last year or the year before, but for guidance he must have the very latest facts as to character of commodities, tariffs and local conditions. These are made available by the Bureau of Information actively reporting trade conditions in other countries. To the manufacturer of hardware, for example, this Bureau will furnish a full report, stating for any one or more countries the lines of hardware most saleable, where and by whom made, how much is sold and at what price, the tariffs, freights and methods of packing and suggestions concerning the business firms best fitted to undertake an agency. The general information obtained by visiting the Museum and consulting its records is free to all, but the special written reports are sent at regular intervals on payment of the expense of preparing them.

Connected with the Museum is a library of trade literature of the world with technical journals, shipping reports, statistical publications and a great variety of information needed by manufacturers and exporters. Access to these facts is facilitated by the card catalogue system, so arranged that reference can be made to individual articles or to countries.

The correspondence necessary for obtaining and sending out this information is carried on in a dozen or more languages by experts, who are either natives of the various foreign countries or have spent a large portion of their lives in the trade centres of the world. It is stated that the Museum is in correspondence with over 30,000 business houses in the United States and with about 20,000 in foreign countries. Financial support is obtained through direct appropriations made by the City of Philadelphia and by fees received from subscribers who receive regular and special reports. Plans are now being prepared for a large exhibit to be made this fall as noted below.

Exhibition of Foreign Products and Manufactures.—By Act of Congress, approved December 21, 1898, an appropriation of $300,000 was made to the Philadelphia Exposition Association, to aid in providing buildings to be erected in Philadelphia for an exposition in 1899 of articles not of American manufacture, and such other objects as may be useful in comparison with American products and manufactures. In addition to this, the sum of $50,000

was appropriated for the purpose of enabling the collection in foreign markets of samples of merchandise in demand in various countries and for illustrating the manner in which such merchandise is prepared and packed, together with information concerning these samples.

The object of this exposition is to lay the foundation of a system of national commercial education, so as to present in the most striking form possible the opportunities for foreign trade and the requirements of various nations. It is designed for business men and business purposes, and in the interest of export trade, but if carried out as planned, the exposition should be of value not only to manufacturers and jobbers, but also to students of geography in its industrial applications. The amount appropriated by the National Government is in addition to sums provided by the State of Pennsylvania, the City of Philadelphia and by various corporations and individuals; all of these coöperating in this movement. The aid of the consular service of the Government has also been secured, and special provisions made for admitting articles free of duty. A large tract of land has been donated for the purpose, and the erection of buildings is about being begun.

A New Mining Bureau.—For many years a discussion has been had as to the desirability and practicability of establishing a Department of Mining, with a secretary, who should be a Cabinet officer, with duties and privileges equal to those of the Secretary of Agriculture. It has been asserted that the mining interest is as important, if not more so than the farming, and that for its stimulation and protection there should be a Government officer in a position to advise the Chief Executive and to coöperate in all the affairs of state. At various conventions the matter has been discussed, and as information has been acquired the demands for a department have gradually subsided, and most of the advocates are willing to accept a bureau under one of the existing departments, as a first step. Action has finally taken the form of a joint resolution introduced by Senator Perkins, of California, to provide for a Division of Mines and Mining in the United States Geological Survey, this being in the Department of the Interior. Mr. Perkins urges that, although the mining interests of the United States yielded during 1897 an increase of about five hundred and ninety-five million dollars, it does not have a clearly defined representation in the organization of the National Government. He further urges that such a representation is greatly needed for the purpose

of gathering and publishing statistics relating to mines and mining, including facts relating to gold and silver as mineral products, and data concerning labor employed and wages earned in the different mining operations. The resolution calls for an appropriation of one hundred and fifty thousand dollars, and provides that the information thus gathered may be published as regular annual reports or as special papers, the size of the edition of each being controlled by its economic importance. This legislation in effect gives a tangible nucleus for an important bureau or sub-department of the Government—greatly needed in view of the fact that the United States is still the owner of enormous tracts of land which undoubtedly contain valuable ores and minerals. The mining laws are notoriously defective, and cannot probably be improved until more complete knowledge is had by the people of the real conditions and of the remedies which should be applied.

WATER CONSERVATION.—A proposition which seems to involve a radical departure in national affairs has been made by Senator Carter of Montana in an amendment intended to be proposed to the River and Harbor Bill. This amendment authorizes the expenditure of five million dollars in building reservoirs and canals to conduct water into these from streams in the States and Territories within the arid region. Up to the present time, although the Government has spent large sums for improving navigation, there has never been any sustained or systematic effort in behalf of water conservation for other purposes. Many of the representatives from States in which there are no navigable waters have claimed that their localities should receive a share of attention in some way or other, and particularly the Western States, where, with scanty population and small returns from direct taxes, the State governments are barely able to keep up the interest on their debts. In these States the Government is the great landowner, holding from one-half to nine-tenths of the area—this land, of course, contributing nothing to the support of the State government. It is coming to be appreciated that unless the owner of the land, that is, the National Government, conserves the water for its reclamation, many of the great resources in agricultural land and in low-grade minerals cannot be utilized.

There is no probability that the proposition for conserving water within the arid region will pass the House of Representatives, for there the representation being by population, the number of Western men is relatively small. In the Senate, however, the

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reverse is the case, for each State having two Senators, irrespective of population, the West holds the balance of power as between the North and the South. Thus, by united effort on the part of the Western Senators, a proposition of this kind can be forced upon the River and Harbor Bill, and in the final adjustment of differences between the House and Senate may have some chance of being retained as an item in the compromise.

It is proposed that the Government shall construct, own and operate the reservoirs and conserve or equalize the flow of water in the streams, turning it back into the natural channels, thus encouraging and facilitating the distribution of the water through the lands needing it. This distribution is to be subject to the laws and regulations of the representative States, these being already established by the respective legislatures. There is great diversity not only in natural conditions but in development of laws regarding water in the different States, some being modelled upon the English Common Law or upon the Statutes brought from the older States, while others have been the result of experience suited to the needs of the country. Thus, while in some States irrigation is encouraged, in others, as on the Pacific Coast, the diversion of water from the streams is made difficult or subject to riparian rights, the exercise of which is almost prohibitory to developments.

Mississippi River Floods.—One of the most important of the minor reports issued by Congress having scientific or geographic bearing is that on Misissippi River Floods by the Senate Committee on Commerce. This is printed as Senate Report No. 1433 of the Fifty-fifth Congress, Third Session. It consists of only thirteen pages, but within these is condensed a review of the operations of some of the great forces of Nature. The causes of the flood are briefly reviewed, and it is shown that the greatest and most destructive have generally come from the Ohio, resulting from excessive rains in the basin of this river and its tributaries. These rains arise from cyclonic storms and warm moisture-laden winds originating in the Gulf of Mexico and passing thence up the central valley into the western slopes and spurs of the Allegheny Mountains, where a colder atmosphere is encountered, leading to heavy precipitation.

The Ohio floods, passing into the Mississippi near Cairo, are frequently reinforced by excess waters from the White and St. Francis Rivers, and other streams in the central valley. Occasion-

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ally the floods from the Missouri and upper Mississippi, to a limited extent, extend or prolong high water in the lower river, but this is true mainly of the important and general freshets rather than of the earlier and more extensive floods. This fact has not been sufficiently well recognized by the public, for it is commonly claimed, in popular discussions, that by the construction of reservoirs at the head-waters of the Mississippi and Missouri the floods on the lower river might be reduced. On this point the report is explicit, in showing that a reservoir on the upper Missouri, while of value for irrigation, would have no material bearing either on the navigation of the Missouri or on the floods in the Mississippi. In the same way reservoirs on the upper Mississippi (five of which have already been constructed) have no material effect below Lake Pepin, which lies between the States of Minnesota and Wisconsin. As for reservoirs on the Ohio, it appears that there are no great basins adequate for the purpose.

One of the opinions rendered will be a source of surprise to many, as it differs radically from commonly accepted views. It is stated that nothing in the evidence or other data obtained tends to prove that the destruction of forests at or near the head-waters tends to cause greater floods. It has been so often asserted that these floods are the result of destruction of the forests, that this has come to be regarded as an established fact, and the complete negation will come as a shock to many enthusiasts. It is stated, on the contrary, that where timber is cut down and the ground not cultivated, the underbrush remains and grows more luxuriantly than before, serving to retard the movement of water on the slope. Where cleared the ploughed area becomes an enlarged absorbent of surface moisture.

The subject of levees, as might be supposed, is the one to which most attention was given. The testimony made clear that the flood of 1897 was in its effects and consequences greatly aggravated by the extensive levee construction which had taken place since the floods of 1882–83 and 1884. It was also shown that if the levees had not existed a larger area would have been submerged. There has been constructed in all nearly 165 million cubic yards of levees, costing about 48 million dollars. Of this 69 million yards were built by the United States at a cost of over 13 million dollars, and 96 million yards by the State or local authorities at a cost of 34 million dollars. To complete the entire levee system, sufficiently high and strong to afford complete protection, will cost upwards of 20 million dollars additional.

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For maintaining navigation it is recommended that additional dredges be provided, rather than that large sums be expended on expensive works for maintaining the channel by revetment works. It is admitted that the latter are efficacious, but the cost is so immense that systematic application is scarcely warranted. In regard to the Missouri River, it is shown that the stream is so erratic and uncertain, that great difficulties are encountered in controlling its movements. Work in recent years has been chiefly confined to the improvement of the navigability of about 45 miles of the lower reach of the river, and to the so-called "harbor improvements" near towns. Such local improvements being isolated and unsupported are, however, usually swept away by the annual overflows. The result is that by reason of the failure to adopt systematic and continuous improvement of reaches, the condition has become so bad as to discourage navigation. N.

SOME NOTES ON OCEANOGRAPHY.

HISTORICAL.—A number of articles have appeared during the past few months upon the history of ancient ocean voyages, which are interesting in this connection. The first which should be mentioned is the "Festschrift" of the Vienna Geographical Society, upon the occasion of the Vasco da Gama commemoration. The address of Dr. Paul Dinse is given in the *Zeitschrift* of the Berlin Geographical Society (Vol. 33, No. 1). There is also a note upon this subject by Prof. S. Ruge, in the *Verhandlungen* of the same Society (Vol. XXV, Nos. 5 and 6).

The voyage of Pinzon-Solis in 1508, when the second discovery of Yucatan was made, is discussed by P. J. J. Valentini of New York, in the Berlin Society's *Zeitschrift* (Vol. 33, No. IV).

There is also another article in the *National Geographic Magazine* (Vol. IX, No. 8), upon the subject of Gomez and the New York Gulf, which shows that this body of water was apparently unknown to the early Spanish cartographers, in spite of their assumptions to the contrary.

EXPEDITIONS.—Scarcely a year in the past decade has been noted for so many deep sea expeditions as the one just closed. In the *Geographical Journal* (Vol. XII, No. 5), the Prince of Monaco gives an account of his work for the past seven years, upon the oceanography of the North Atlantic.

Among the more noteworthy of the remaining expeditions are those of the *Valdivia*, the *Oceana*, the *Pola*, the *Siboga* and the *Helgoland*. The Austro-Hungarian expedition on the *Pola* has done an interesting piece of work upon the Red Sea. Notes upon this expedition are to be found in the *Geographical Journal* (Vol. XII, No. 6). And there is also a review of the report of Dr. Gräffe, on the microscopical organisms of the surface and bottom collections, in *Petermanns Mitteilungen, Litteraturbericht*, 619, on page 150.

A programme of the Dutch Deep Sea Expedition to the East Indian Archipelago in the *Siboga* is to be found in the *Geographical Journal* (Vol. XIII, No. 1), and a note upon the work in *Petermann* (1898, page 120).

Probably the most elaborate expedition of all those fitted out during the past year, was the German Deep Sea Expedition under Dr. Gerhard Schott. A preliminary report by Dr. Schott appears

in the Berlin Society's *Verhandlungen* (Vol. XXV, No. 10), in which he describes the course of the *Valdivia*, the apparatus for the oceanic work, the results obtained in the various scientific lines and also the meteorological work which was done upon the trip. There are notes upon this subject in *Petermann* (1898, pp. 120 and 264).

The North Sea Expedition of the *Helgoland* under Capt. Rüdiger was mainly a zoological expedition, but considerable bacteriological work was also done, besides hunting, sketching and the collection of materials for literary work. A considerable amount of oceanographical, meteorological and geographical material was obtained in the shape of observations. A digest of the work appears with a chart in the Berlin *Verhandlungen* (Vol. XXV, Nos. 8 and 9).

A note upon the work of the *Oceana*, upon the west coast of Ireland and on the border of the Continental Plateau, under the conduct of Mr. George Murray, of the British Museum, appears in *Petermann* (1898, p. 264), and a preliminary report is published in the *Geographical Journal* for February, 1899.

TIDES.—A considerable number of articles have appeared upon this subject recently, but the most important contribution which has appeared for years has been Dr. Darwin's book on the Tides, which has instantly sprung to the first rank, as a classic upon this subject. There is a notice of this work in *Science*, for Dec. 23, 1898.

Another article in *Science* (Dec. 9, 1898) discusses the limitations of the present solution of the tidal problem.

A series of articles upon the subject of tides by M. S. W. Jefferson has appeared in the *National Geographic Magazine* (Vol. IX, Nos. 9, 11 and 12). These articles discuss the subject of the tides of the open Atlantic Ocean, the estuarine and coastal tides of the Atlantic. They form a series of theses presented in the Research Course in Geography at Harvard University.

The tidal phenomena in the English Channel, and the Southwestern portion of the North Sea, have been discussed by Prof. C. Börgen in the *Annalen der Hydrographie* (1898, pp. 414 and 462).

In the Proceedings of the Canadian Institute, N. S. (Vol. I, pp. 28, 55 and 134), is an interesting series of communications from F. N. Denison, on the subjects of secondary undulation on tide gauges; the Great Lakes as a sensitive barometer, and the origin of ocean tidal secondary undulations.

The deep currents in the straits of Bab-el-Mandeb, and some observations upon the surface currents in the same locality, are described in the *Annalen der Hydrographie* (1898, p. 519).

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In the same journal (1898, p. 10), there are observations upon the currents and color phenomena in the waters off the coast of Guiana. A note upon the Current Charts of the Pacific Ocean is found upon p. 226 of the same publication. On p. 405, the currents on the coast of Chile are described by Capt. Hoffmann. And the Chart of Oceanic Currents by G. Schott is reviewed by Dr. Neumayer on p. 409.

METEOROLOGY.—The work of Doberck on the law of storms (Hongkong, 1898), has been translated by Dr. Paul Bergholz of Bremen, and the section on Typhoons on the east Asiatic waters has appeared in *Gaea* (XXV, Nos. 1 and 2), and also in the *Meteorologische Zeitschrift* (1898, p. 332). There is also a note upon the same subject as brought to the attention of mariners by the pilot chart for the North Pacific (Aug., '79) in the *Zeitschrift* for Feb., 1898, p. 68.

An article containing some doubtful, or at least hazardous, conclusions upon the Winter winds of the North Atlantic Ocean, and the Anti-Monsoons of Africa is contained in the *Litteraturbericht* (p. 16) of the *Zeitschrift* for Jan., 1898.

Dr. W. Meinardus has discussed the relations of the winter climate of Middle and Northwestern Europe to the Gulf Stream in the Berlin Geographical Society's *Zeitschrift* (Vol. XXXIII, No. 3). In connection with this, three charts are given which are most satisfactory.

The yearly rainfall upon the oceans is discussed by Prof. A. Supan, in *Petermann* (1898, p. 179), and the article is accompanied by a chart.

Charts of the yearly isothermal and isabnormal lines upon the oceans are given by Prof. W. Köppen, in Table 9 of the *Annalen der Hydrographie*, 1898, and the explanatory text is to be found upon p. 356 of the same journal.

The elaborate article of Gerhard Schott upon the fogs of the Newfoundland Banks, in the *Annalen*, 1897, is reviewed by Dr. Meinardus in the *Meteorologische Zeitschrift* for January, 1898.

The *Annalen*, for 1898, publishes (p. 10) a list of all the important ocean earthquake waves which have been brought to the attention of the German Hydrographers, and (p. 312) a most instructive and carefully prepared article by Dr. O. Petersson upon the subject of the methods of hydrographic investigation.

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A NEW MOUNTAIN ANEROID BAROMETER.

A Letter from Mr. E. Whymper.

Mr. Murray published in 1891 a pamphlet [*How to use the Aneroid Barometer*, 8vo, pp. 61, John Murray, Albemarle St., London], which gave some of the results that had been obtained from numerous comparisons of the Aneroid against the Mercurial Barometer, made by me between the years 1879 and 1890. The earlier of these comparisons were made out of doors up to a height exceeding 20,000 feet; and the later ones were made in the workshop down to a pressure of 14 inches, which is about what one may expect to experience at the height of 20,770 feet above the sea.

These comparisons, or experiments, brought out certain facts. It was found that all aneroids which were tested, upon being submitted to diminution in atmospheric pressure, lost upon the mercurial barometer. It was found, if an aneroid was placed under the receiver of an air-pump (having a mercurial barometer attached, in such a way that one could cause simultaneous reduction in pressure for both barometers), that, although the aneroid might for a moment read truly against the mercurial when pressure was reduced say to 20 inches, it would in a very short time read *lower* than it. It was found that this loss augmented constantly, and that in a single day, under a constant pressure of 20 inches, it might grow to half an inch and even more; and, that the loss always continued to augment for several weeks, sometimes so long as seven or eight weeks. The lower the pressure, and the greater the length of time the diminution in pressure was experienced, the greater was the loss in any individual aneroid.

It was found also that aneroids commenced to recover this loss immediately pressure was restored: no matter whether it was restored entirely and suddenly, or gradually and partially as it is when a traveller is coming down-hill; and that in course of time after return to the level of the sea (or if kept artificially at a pressure of 30 inches or thereabouts) an aneroid might recover all its previous loss, even although it might have experienced very low pressures, and been kept at such pressures for months at a time. Hence, in consequence of the *loss*, Travellers or Surveyors may be led to very much exaggerate their altitudes (unless they carry some standard for comparison which will enable them to determine the errors of their aneroids on the spot); and in consequence of the *recovery* they may be led to believe, on return to the level of the sea, that their aneroids have been working well and truly, although they may have, as a matter of fact, been doing quite the reverse.

The publication of these results led to improvements in the manufacture of the Aneroid, and *some* instruments of the best class which have been constructed in late years show a distinct advance in accuracy; but it is clear, from references which have been made quite recently by Travellers to their aneroids, that there are *others* which are still a long way from perfection. Mr. E. A. Fitzgerald, for example, says in the *Geographical Journal*, Nov., 1897, "Our aneroids played us some very curious tricks One of them, on being taken to the height of 19,000 feet, registered 12 inches"—that is to say it indicated an altitude of about 25,000 feet, and was about 30 per cent. in error. This is several degrees worse than the behaviour of the instrument which was employed by Mr. J. Thomson during his journey in Morocco in 1888, though even *his* aneroid is said to have made his life a burden to him. One can well believe it did all that was imputed to it; for after Mr. Thomson's return, when it was tested under the air pump at a pressure corresponding to a little lower than the height of Mont Blanc, upon being kept a week at that pressure, it acquired an error of — 1.267 inches, the value of which amount, at the altitude in question, exceeds 2,000 feet.

Manufacturers have endeavoured to tackle the difficulty in one way, and inventors have approached it in another. The former have attempted to abolish the fundamental cause of error, and the latter see that Aneroids can be rendered of greater service in the measurement of altitudes by shortening the length of time that they need be exposed to the influence of the atmosphere. The most recent experimental Aneroid which has been constructed with this view is the invention of Col. H. Watkin, C.B., Chief Inspector of Position-Finding in the War Department.

In introducing it, Col. Watkin said in effect, though not in these words, "You point out that all aneroids lose upon the mercurial barometer when submitted to a diminution of pressure; that this loss it large when pressure is much diminished; and that the loss continued to augment for several weeks. Is is, you say, apparent that the *extent* of the loss which will occur in any aneroid upon the mercurial barometer on being submitted to a diminution in pressure depends (1) Upon the duration of time it may be submitted to diminished pressure, and (2) upon the amount of the diminution in pressure; and that it follows that the errors which will be manifested by any particular aneroid will be greatest when it is submitted to very low pressures for long periods. Accepting this as a correct statement of facts, I propose to construct an Aneroid Barometer that can be put in action when required, and 'put out of gear' or 'thrown out of action' when it is not wanted for use; and I propose to construct it in such a way that it shall not be exposed to the influence of variations in atmospheric pressure when it is *out* of action, in short, that no variation in atmospheric pressure, however large they may be, shall

produce any effect upon it except at the time when it is put in action for the purpose of taking a reading." The following description, supplied by Col. Watkin, explains the manner in which this is done:—

"In order to relieve the strain on the mechanism of the Aneroid, and only permit of its being put into action when a reading is required, the lower portion of the vacuum-box instead of being a fixture (as is the case with ordinary instruments) is allowed to rise. Without entering into details of construction, this is effected generally by attaching to the lower portion of the vacuum-box a screw arrangement, actuated by a fly nut on the outside of the case. Under ordinary conditions this screw is released, and the vacuum-box put out of strain. When a reading is required, the fly nut is screwed up as far as it will go, thus bringing the instrument into the normal condition in which it was graduated."

At first mention this idea did not appear promising, as it seemed that, however quickly an observation might be made, the aneroid would be losing upon the mercurial all the time that the reading was being taken; that when the aneroid should be thrown out of action, this loss would be shut up; and that when readings should be taken on succeeding occasions the loss which would occur during them would accumulate; and that this would go on until at length the error would become almost or quite as serious as in an ordinary aneroid. I was, however, very urgently required to give the instrument a fair trial in the field; and after satisfying myself that, when thrown out of action, it was not affected by variations in atmospheric pressure (amongst other ways by keeping it for six weeks under a receiver in which pressure was maintained constantly at 17 inches), I commenced to compare it against the mercurial barometer in Switzerland in last September, having intentionally refrained from taking a reading for six weeks further, after it was released from the air-pump, in order to obtain confirmation of the opinion that it was, when thrown out of action, actually impervious to the influence of variations in atmospheric pressure.

I commenced these comparisons at Zermatt on the 3rd of September [the height of Zermatt, according to the Swiss Federal Survey, is 5315 feet], and between the 3rd and the 8th took 21 readings—that is to say, the aneroid was put in action and was thrown out of action 21 times in the above-mentioned period. I was interested to observe whether the accumulation of loss would take place. It did occur, but the total amount was small. The aneroid had a plus error of 0.122 of an inch the first time it was used, and this was reduced to +0.069 of an inch at the last reading. Thus there was, on an average, a loss of 0.00252 (or $\frac{252}{100000}$) of an inch on each occasion that a reading was taken.

On September 9th I carried the barometers to the top of the Gornergrat, but diverged from the way up to the summit of a minor peak called Gugel [S. F. Survey, 8882 feet]. The error of the aneroid at Zermatt at the last reading was +0.069 of an inch, and on the top of Gugel it was +0.057, or $\frac{57}{1000}$ of an inch. The difference of level between the stations, it will be seen, was 3567 feet.

From the top of Gugel I came down for lunch to the hotel called the Riffelhaus [S. F. Survey, 8429 feet], and there the error of the aneroid was +0.041 of an inch.

From the Riffelhaus I went to the top of the Gornergrat [S. F. Survey 10,289 feet], and at 4.20 P.M. the error of the aneroid appeared to be — 0.052 of an inch. The readings were

MERC. BAR. INCHES.	TEMP. IN SHADE.	CORRECTION FOR TEMP. INCH.	MERC. BAR. RED. TO 32° F. INCHES.	ANEROID INCHES.	ERROR OF ANEROID. INCH.
20.923	55.5	—0.051	20.872	20.820	—0.052

I was not satisfied with this comparison. The sun's rays had been piercingly hot during the ascent, and the mercurial barometer had been unavoidably exposed to them. When set up in the shade, its sensitive, attached thermometer speedily took up the temperature of the air. It fell to 55.5 F., and would not fall lower. But the mercury in the barometer continued to fall long afterwards, because it was not cooled down to the temperature of the air. It is not improbable that the temperature of the mercury in the barometer was as high as 75° F. at the time it was read. Assuming that this was the case the following would be the correct comparison.

MERC. BAR. INCHES.	TEMP. OF MERCURY.	CORRECTION FOR TEMP. INCH.	MERC. BAR. RED. TO 32° F. INCHES.	ANEROID INCHES.	ERROR OF ANEROID. INCH.
20.923	75°	—0.087	20.836	20.820	—0.016

On my return to Zermatt after a descent of 4974 feet, I was curious to observe what alteration there would be in the error of the aneroid. At the last reading prior to starting it had been +0.069 of an inch, and at the first one taken after the return it was precisely the same! More astonishing than this, the mean of eight readings taken on the four following days (Sept. 10–13) came out +0.069 of an inch.

On September 13th I went again to the Gornergrat, and between 12–3 read the barometer three times. The following figures show the means of the three readings.

MERC. BAR. INCHES.	TEMP. IN SHADE.	CORRECTION FOR TEMP. INCH.	MERC. BAR. RED. TO 32° F. INCHES.	ANEROID INCHES.	ERROR OF ANEROID. INCH.
20.780	56° F.	—0.052	20.729	20.717	—0.012

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This supported the opinion that the reading on September 9th was taken too soon, and that the temperature indicated by the attached thermometer was lower than the temperature of the mercury in the barometer. The mean of two comparisons at Zermatt after this second visit to the Gornergrat gave as the error of the aneroid +0.030 of an inch.

I then went down the Valley of Zermatt, and stopped successively for several days at each of the three villages, Randa, St. Nicholas, and Visp. At Randa [S. F. Survey, 4741 feet], I made six comparisons on three days, and the mean error of the Aneroid came out 0.000. At St. Nicholas [S. F. Survey, 3678 feet], I took five readings on three days, and the mean error was — 0.019 of an inch; and at Visp [S. F. Survey, 2165 feet], I took three readings on two days, and the mean error was — 0.006.

I then thought it would be well to submit the Aneroid to a sharp and sudden diminution in pressure, and took the train back to Zermatt to see what would happen through a rise of 3150 feet, made in 2 hrs. 20 min. At the last reading at Visp, the error was — 0.002 of an inch, and at Zermatt I found it was +0.011. On return to Visp the mean error of five comparisons made on three days was +0.017 of an inch; at Sierre [S. F. Survey, 1765 feet], five readings on four days shewed a mean error of — 0.010, and the mean error of the last two comparisons, made at Geneva [S. F. Survey, 1227 feet], amounted to — 0.030 of an inch. From September 9th to October 17th the aneroid was put in action 44 times, and its loss upon the mercurial in that time amounted to 0.099 of an inch. A plus error of 0.069 of an inch at Zermatt was changed into a minus one of 0.030 of an inch at Geneva. This was equivalent to a loss of 0.00225 (or $\frac{225}{100000}$) of an inch on each occasion that it was used.

The remarkable nature of these figures will be apparent to anyone who has acquaintance with the barometer, and especially to those who have used Aneroid Barometers in the field. Upon two occasions, Col. Watkin's instrument read so truly against the mercurial that I was unable to detect any discrepancy between the two instruments. At Randa, the mean of six readings gave as a result *no* error. Stress need not be laid upon these happy agreements. It is more to the purpose to draw attention to column G in the following table. If the eye is run down that column, and neglects the hun-

A PLACE OF OBSERVATION.	B DATE. 1898.	C ALTITUDE.	D MERC. BAR. REDUCED TO 32° F.	E WATKIN'S MOUNTAIN ANEROID.	F NUMBER OF OBSERVATIONS.	G MEAN ERROR OF ANEROID.
			Inches.	Inches.		Inch.
Zermatt	Sept. 3–8	5315 ft.	25.006	25.096	21	+0.090
Top of Gugel	" 9	8882 "	21.963	22.020	1	+0.057
Riffelhaus	" "	8429 "	22.319	22.360	1	+0.041
Top of Gornergrat	" "	10,289 "	20.872?	20.820	1	—0.052?
Zermatt	" 10–13	5315 "	24.912	24.980	8	+0.068
Top of Gornergrat	" 13	10,289 "	20.729	20.717	3	—0.012
Zermatt	" 13–14	5315 "	24.917	24.947	2	+0.030
Randa	" 15–17	4741 "	25.687	25.687	6	0.000
St. Nicholas	" 17–22	3678 "	26.443	26.424	5	—0.019
Visp	" 23–29	2165 "	27.726	27.720	3	—0.006
Zermatt	" 30	5315 "	24.475	24.492	2	+0.017
Visp	Oct. 4–7	2165 "	27.890	27.907	5	+0.017
Sierre	" 9–12	1765 "	28.131	28.121	5	—0.010
Geneva	" 13–17	1227 "	28.332	28.302	2	—0.030

dredths and thousandths of an inch, it will be seen that it reads 0.0 from first to last! Better results might have been attained, and I believe would have been attained, if the readings had been taken with greater rapidity. Attention must be paid to two points when employing this instrument. The first is to keep it constantly shut off from the influence of the atmosphere, except at the times when readings are to be taken; and the second is to take the readings as quickly as possible.

Finally I feel confident that, in the hands of those who will give the requisite attention, extraordinary results may be obtained from Watkin's Mountain Aneroid in observations made for altitude, and in determining differences of level.

The comparisons were made against a Mountain Mercurial Barometer, Fortin principle, which was graduated to read on the vernier to $\frac{1}{500}$ of an inch, and by estimation could be read to $\frac{1}{1000}$. Before starting in July, this Barometer was compared against its Maker's Standard and it was found to have no error. On return in October it was again examined and compared, and it was found that it had not taken in any air.

The Aneroid which was observed was 4½ inches in diameter, and was divided to 0.05 of an inch. Its scale ranged from 31 to 17 inches, and it weighed when in its leather sling case 2½ lbs. It was made by Mr. J. J. Hicks, 8, Hatton Garden. Aneroids of this type will be called Watkin's Mountain Aneroids, as they are especially devised for Mountain Travellers, and for Survey work amongst mountains.

EDWARD WHYMPER.

MAP NOTICES.

BY

HENRY GANNETT.

Since our last notice, the U. S. Geological Survey has issued twelve sheets of the Topographic Map of the United States, scattered over various parts of the country.

Keene sheet represents an area of some 220 square miles, in southern New Hampshire, upon a scale of 1:62,500, with a contour interval of 20 feet. The area here represented is one of rounded granite hills, the remains of the great highland that once occupied this part of New England.

In New York are three sheets, all on a scale of 1:62,500, and with a contour interval of 20 feet. One of them, Oyster Bay, is situated upon the north shore of Long Island, and represents a region of petty glacial hills, a part of the terminal moraine of the continental glacier; the other two, Moravia and Auburn, are in the central part of the State. The former shows a plateau-like region, deeply cut by stream channels; the latter includes parts of Cayuga and Owasco lakes. In the northern part are numerous beautifully elongated drumlins, whose axes trend a little east of south.

The Oceana sheet represents an area in the Cumberland plateau, in the southern part of West Virginia. It is a maturely dissected region, being composed of sharp, narrow ridges and narrow gorges, forming a very complete drainage system. Formerly base-levelled as a plateau, whose surface consisted of a hard bed of carboniferous limestone, it was subsequently tilted to the northwest, and erosion has produced the present form of the surface. At the time it was base-levelled, the streams became extremely crooked and winding, and in the subsequent erosion their character has been preserved, the crooks and turns being deeply incised. The scale of this sheet is 1:125,000, with a contour interval of 100 feet.

Upon the upper peninsula of Michigan are three sheets, Witbeck, Iron River and Sagole, all upon a scale of 1:62,500, with a contour interval of 20 feet. The areas here represented underlay the great glacier, whose former presence is betrayed by the irregularities in the courses of the streams, numerous lakes, many of which are without outlets, irregular depressions and elevations, drumlins, moraines and marshes.

In South Dakota is one sheet, DeSmet, on a scale of 1:125,000, with a contour interval of 20 feet, which also represents a glaciated region, although the surface is by no means as irregular as in the Michigan sheets, above mentioned.

In Nebraska is the David City sheet, on a scale of 1:125,000, with a contour interval of 20 feet. Within this area Loup River, coming from the north, joins the Platte. The former, although a plains stream, carries considerable water, while the Platte, heading in the mountains of Colorado and Wyoming, is, at the point of junction, practically dry. The bottom land of the Platte here is very broad, and is bordered upon the south by a line of bluffs a hundred feet or more in height, and almost from the edge of these bluffs the drainage turns southward through Blue River to the Kansas.

In Montana is one sheet, Boulder, on a scale of 1:125,000, with a contour interval of 100 feet. This represents a mining region in the Rocky Mountains near Helena.

In California is one sheet, Haywards, representing the southeastern part of San Francisco Bay, with a bit of the coast ranges east of it.

The U. S. Geological Survey has issued a map of Indian Territory, upon a scale of 1:500,000. This map is a compilation from the plats, resulting from the subdivisional surveys which have been executed by this organization during the past three years. A comparison of this map with that issued by the Land Office some years ago, which was compiled from exploration, railroad surveys, etc., shows the extent of errors which are possible even in well settled regions. Great areas are five and six miles out of place. Indeed, it is surprising that such gross errors, affecting large areas of country, should not have been detected and corrected even by the railroad surveys.

This edition of the map makes no attempt at representing the relief, which will doubtless be added in later issues.

BOOK NOTICES.

Report of the Intercontinental Railway Commission, in three volumes, volume one being in two parts, with three portfolios of maps. Quarto. Washington, 1898.

This magnificent series of reports and maps are the tangible results of extensive surveys made during the years 1891–2–3 under the joint auspices of the United States and the Central and South American countries, for the discovery of a feasible railway route, connecting North, Central and South America.

It will be recalled that this work is one of the results of a conference invited by this country and participated in by the representatives of most of the republics of Central and South America, which met in 1889, for the purpose of promoting closer commercial relations among the countries of America. The most important recommendation of this conference was for a survey and exploration of practicable railroad routes connecting these countries, and providing that the expenses of the survey and exploration be defrayed by the respective countries in amounts proportional to their population. This recommendation was carried out, the work has been executed, and these volumes and maps form the report upon it.

The work was carried on by three parties. Party No. 1 executed the survey in Central America from Ayutla, near the south boundary of Mexico, southeastward through Costa Rica. Party No. 2 surveyed a line northward from Quito through Ecuador and Colombia; and Party No. 3 southward from Quito to Cuzco, Peru. Work was commenced early in the summer of 1891 and concluded in June or July, 1893. The total expenses of the survey amounted to nearly $300,000, including publication. Of this the United States contributed $245,000, or about five-sixths of the whole. This country contributed not only its full quota in money, but also the expenses of printing the report, amounting to $50,000. It is interesting to note to what extent other nations bore their share of the burden. Ecuador and Guatemala contributed their full quota; Brazil and Costa Rica two-thirds of their quota, and Bolivia, Chile and Colombia one-third only, while the other countries contributed nothing.

Volume I, part I, gives in 164 pages a history of the Commission, the character of the field work of the survey and a summary

of the reports of the three divisions, including a physiographic and economic description of the territory examined. In a pocket at the end of the volume are maps and profiles, including a map of America, showing routes explored: of Central America, of Colombia, of Ecuador and Peru, and of parts of Mexico, all on a scale of 1:1,800,000; of parts of Peru, Chile, Bolivia, Argentina and Brazil, on a scale of 1:5,400,000, and maps of parts of Mexico on a scale of 1:600,000.

Volume I, part II, consists of a detailed report of the work of corps No. 1; Volume II, of corps No. 2, and Volume III, of corps No. 3. All these reports are printed both in English and Spanish, and each volume is accompanied by a portfolio of maps and profiles illustrating the routes and adjacent country. The maps are upon a uniform scale of 1:48,000, and the relief is expressed by contour lines. Drainage is printed in blue, culture in black, and relief in brown. The surveyed routes are printed in red.

This work is one of the most notable contributions to descriptive geography which has been made in recent times. The line of survey traverses the volcanic regions of Central America, and, south of the Isthmus of Panama, it soon reaches the high Andean plateau, the summit of which it follows for several degrees of latitude, keeping at great altitudes above the sea. In connection with this line of survey a belt of country of variable width has been mapped, in many cases including the summits of high peaks, and altogether including an enormous area of unknown or little-known land.

The dress of the report is in keeping with its value. It is well printed on heavy paper, beautifully illustrated with half-tones, and the maps are finely engraved and printed. H. G.

Physical Geography; William Morris Davis, assisted by William Henry Snyder: Ginn & Co., Boston, and London, 1898. Pp. XVIII+428, with 261 illustrations and 9 plates.

Davis's Physical Geography for Secondary Schools has received a very hearty and much-deserved welcome from all interested in the subject, and especially from secondary school and academy teachers. It is by far the best book for the schools for which it is intended, and will undoubtedly do more to benefit the cause of physical geography teaching than any of its predecessors.

Omitting a brief and suggestive introduction, the book may be divided into four parts: The Earth as a Globe, The Atmosphere,

The Ocean, and The Lands. To this last division 340 pages of the book are devoted, thus giving proper emphasis to the part of the earth that is the home of man. Under the other divisions only such phenomena are discussed as are necessary to understand the relation of man to the earth. For the first time in books of this sort we find what seems to us a judicious and rational selection from the host of facts that might be included in such a treatment. As a result of such selection the book has far greater unity and interest than is usual, and is much more usable in classes. Again, such a choice allows an important subject to be considered at sufficient length and with sufficient care to leave clear and vivid impressions. For instance, the phenomena of tides and waves that are usually touched upon in such a way that the reader is left in as great ignorance as before, are here considered clearly, concisely and graphically, and with success. The same might be said of several other topics usually not well done.

The book is well equipped with illustrations, reproduced from photographs and drawings, and with diagrams. The latter are very valuable and to the point, and except in one or two instances where the perspective is in error they are very successful and of great help to the teacher and student. Unfortunately, the reproductions from photographs and drawings are not so successful; in part because of the process used, but more particularly because of an absence of scale. Kangaroos and beaver, with no accompanying scale for comparison of size, are of questionable value. If the reader knows enough of the animals to get a clear impression, the picture is unnecessary; if he does not, the picture is merely suggestive, not clear.

Contrary to the expectations of the critics who questioned the value of the book before it appeared, the author has omitted most of the technical nomenclature that has arisen in this subject in the last decade. There are, however, many new terms, but they are not technical and usually appeal to the common sense of the reader in such a way as to be used freely from a sense of the need of just such expressions.

For the first time we find an adequate and scientific consideration of the development, classification and meaning of land forms in an elementary text-book. Particular emphasis is laid upon the relations of life to the earth in a causal way, thus placing the effects in their true relations to their physical causes. Irrelevant material, such as classification of plants and animals, description of

rocks and minerals, is rightly omitted, thus preserving the unity and seriousness of the book.

The book is provided with a series of appendices devoted to a consideration of problems for laboratory work, to a series of well-chosen references, and to a number of maps. These latter are, however, not very satisfactory or clear, and are not sufficiently devoted to physical features.

The author has had the help of a very successful teacher of physical geography in a large academy, and thus his book has, as it were, been tested in practice before publication. As a result the book is well fitted for the better schools. The teacher who has come under the direct or indirect influence of the author will be able to use this text to the best advantage; but any teacher interested in the subject and abreast with the times will find here her best guide and help.

All interested in the cause wish the book great success, and those not interested in secondary school geography are glad to have the book for reference.

The author deserves the compliment of praise and of usage, and we trust he may receive both in large abundance. R. E. D.

With Peary near the North Pole. By Eivind Astrup. With Illustrations from Photographs and Sketches by the Author. Translated from the Norwegian by H. J. Bull. London: C. Arthur Pearson, Limited. Philadelphia: J. B. Lippincott Company. 8vo. (1898.)

Three years ago Mr. Astrup was found dead in the woods in the Lille Elvedal, in southern Norway; a lamentable end for a man not yet twenty-five years of age, full of energy, courage and promise.

The history of his book is told in the short *Preface:*

> It happened that for a couple of years I passed beyond the pale of civilization, and visited places where none had ever been. These things I had, of course, to describe; . . . But then people would come and ask me, "When shall we get your book?" . . . The result of my literary activity I hereby venture to place before the public, hoping that they will not be too critical.

Astrup writes modestly and well. He keeps himself in the background, even when describing the long marches, in which he was Peary's one companion.

Much of the volume is devoted to the Eskimos, their homes, their belief, their games and hunting exploits.

Astrup went to Greenland by chance. He was in Philadelphia, with a fancy in mind of going to Africa, when he read a paragraph

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about Peary's proposed expedition. He wrote to offer his services and was asked to present himself. This he did, armed with an English dictionary in one pocket and a Norwegian dictionary in the other, to look up a word, at a pinch :

> A young man of African origin, the afterwards illustrious "Matt," showed me into Lieutenant Peary's working-room, where I was most heartily received by the explorer. His whole appearance inspired me with absolute confidence. His tall, lean figure was elastic and sinewy ; his features, coarse but determined, were aglow with intrepid resolution.

A less happy adjective than *coarse* could hardly have been found in the two dictionaries ; but it was, perhaps, the choice of the translator, Mr. Bull, to whom, also, seems to belong the vulgarism of *Matt, the nigger*, on page 16. On the whole, however, the English is fair, and the book leaves a pleasing impression of its young author.

The paper and print are good; and the illustrations, which include a portrait of Astrup, are well reproduced.

By Way of Cape Horn. Four Months in a Yankee Clipper. By Paul Eve Stevenson, author of "A Deep-Water Voyage." Illustrated from Photographs taken by the Author. Philadelphia : J. B. Lippincott Company. 1899.

Many men have made the voyage round Cape Horn, but few undertake it, as Mr. Stevenson did, for pleasure. He says in his preface:

> The pleasure which such a voyage affords the fortunate few, in whom there is a real affection for the sea, is quite indescribable. To such there is no monotony, for there is always something interesting and amusing going on aboard ship, if one's eyes are open ; the men themselves present an inexhaustible field for study and reflection. . . .

Mr. Stevenson's eyes and mind were open and he saw wonderful things; the peaceful beauty of the ocean under the warmer sky, the strange constellations, the albatross riding the storm, the sunsets off Cape Horn, and even the cape itself, which so few have seen.

On board the ship he studied the officers and the crew in a way that recalls Dana's observations in his *Two Years Before the Mast ;* though Dana, as a sailor, was closer to the men whom he studied. They lead a hard life, these men

> Housed on the wild sea, with wild usages,

and Mr. Stevenson has to tell of painful scenes of cruelty and

brutality, practised now, as he declares, almost exclusively in the American merchant marine.

The book is well printed and handsomely bound, and the illustrations are uncommonly good.

The Prehistoric Arts, Manufactures, Works, Weapons, etc., of the Aborigines of Australia. Compiled and Collated by Thomas Worsnop, Town Clerk, Adelaide, South Australia: C. E. Bristow, Government Printer, North-Terrace, Adelaide, 1897.

This compilation is the result of efforts continued for twenty-five years, in the intervals of official duty, to rescue from oblivion some of the antiquities of Australia. The preface closes with these words:

> I deeply regret my own carelessness in allowing many valuable opportunities to slip which occurred during my early life in this province of recording, and daily, the numerous religious rites and grand festivals I have witnessed, together with occasional discoveries of cave paintings and of carvings, both on rock and on wood. Nevertheless, I trust in the things now recorded sufficient interest will be excited as to press upon the public attention the necessity of attempting in our own time and day the careful collection of copies of every artistic work of the Australian aborigine which may at any time come under personal observation. Failing this, like the tribes themselves, these pictorial records may soon disappear and be no more known.

Mr. Worsnop acknowledges the help received from many persons whom he names, and the bulk of his volume is made up, of course, from the published works of navigators and scholars,—Flinders, Sir George Grey, Brough Smyth and others—; but his own contribution is not insignificant.

Separate chapters are devoted to the native drawings, including tree carvings, cave and rock paintings, with an account of the pigments and their preparation; to sculpture and carvings; to clothing, which in the early days shone by its absence; to native tombs, with description of the funeral ceremonies; to dwellings and sleeping places, with mention of the stone circles, so numerous in Victoria; to domestic utensils, of many kinds and all, particularly the water bags and baskets, showing great ingenuity and skill in manufacture; to road-making, quarries, weapons, navigation, dances, tattooing and games.

In the chapter on road-making is the description of a dam, seen by Ernest Giles in South Australia, lat. 30° 43′, long. 132° 44′:

> . . . On arriving at it we saw that it was a circular wall or dam of clay, nearly 5 feet high, with a segment open to the south to admit and retain the rainwater that occasionally flows over the flat into this artificial receptacle. This wall or dam is the first piece of work of art or usefulness that I have ever seen in Australia, and if I

had only heard of it I should seriously have reflected upon the credibilty of my informant, because attempts of skill or ingenuity on the part of Australian natives in any way applied to building or storing of water have never previously been met with, and I was very much astonished at beholding it now. This piece of work was 2 feet thick on the top of the wall, 20 yards in the length of its sweep, and at the bottom, where the water lodged, the embankment was nearly 5 feet thick.

Mr. Giles and his party were afterwards saved from death by thirst by the water in a similar dam found in the desert farther to the north.

Reproductions of native drawings, some of them in color, and of scenes in the native life, add to the interest and value of this work.

ACCESSIONS TO THE LIBRARY.

JANUARY–FEBRUARY, 1899.

BY PURCHASE.

Commercial Directory of the American Republics, Vol. II., Washington, 1898, 4to; Dictionary of National Biography, edited by Sidney Lee, Vol. LVII, London, 1899, 8vo; The Imperial and Colonial Constitutions of the Britannic Empire, by Sir Edward Creasy, London, 1872, 8vo; Language and the Study of Language, by William D. Whitney, New York, 1867, 8vo; Oriental and Linguistic Studies, by William D. Whitney, New York, 1873, 8vo; Mardi, by H. Melville, New York, 1849, 2 vols., 12mo; Conventions Internationales, etc., en Afrique, par F. Van Ortroy, Bruxelles, (1898), 8vo; The Life and Adventures of Sig. Gaudentio di Lucca, etc., Norwich, (Conn.), 1796, 8vo; Résumé de l'Histoire de St. Domingue, etc., par Raban, Paris, 1825, 12mo; Three Thousand Miles through the Rocky Mountains, by A. K. McClure, Philadelphia, 1869, 12mo; Personal Narrative of a Tour through a Part of the United States and Canada, by James Dixon, New York, 1849, 2d edition, 12mo; Six Months of a Newfoundland Missionary's Journal, (by Edward Wix), London, 1836, 12mo; Mes Voyages avec le Docteur Philips dans les Républiques de La Plata, etc., par Armand de B., Tours, 1861, 8vo; The First Plymouth Patent: Granted June 1, 1621, edited by Charles Deane, Cambridge, (Mass.), 1854, 4to; Thirty Years in California, by S. H. Willey, San Francisco, 1879, 8vo; Description of the Eastern Coast of the County of Barnstable, Boston, 1802, 12mo; A Short State of the Countries and Trade of North America, claimed by Hudson's Bay Company, London, 1749, 8vo; Reasons to shew, that there is a great Probability of a Navigable Passage to the Western American Ocean, etc., London, 1749, 8vo; A Short Narrative and Justification of the Proceedings of the Committee, etc., to prosecute the Discovery of the Passage to the Western Ocean, etc., (by Arthur Dobbs), London, 1749, 8vo; Reports, Delaware and Hudson Canal Company, 1837, 1841–1860, 1864, 1868–1873, (27 pamphlets) New York, 8vo; Cabot and the Transmission of English Power in North America, an Address by Justin Winsor, New York, 1896, 8vo; Geology and Industrial Resources of California, by Philip H. Tyson, Baltimore, 1851, 8vo; Travels in India 100 Years Ago, with a Visit to the United States, by Thomas Twining, London, 1893, 8vo; Seeking the Golden Fleece: Pioneer Life in California, by J. D. B. Stillman, San Francisco, 1877, 8vo; A Long Vacation in the Argentine Alps, by H. C. Ross Johnson, London, 1868, 8vo; City Atlas of Albany, N. Y., Philadelphia, 1876, 4to; Maps of the Street Lines of Boston, 1819–1820, by John Groves Hales, Reproduced in Facsimile, Boston, 1894, folio; Historia de Mindanao y Joló, por P. Francisco Combés, Madrid, 1897, 4to; Estadismo de las Islas Filipinas, etc., por Fr. J. Martínez de Zúñiga, 2 Tomos, 1893, 8vo; Archivo del Bibliófilo Filipino, por W. E. Retana, Tomo 3, Madrid, 1897, 8vo; Filipe Segundo Rey de España, por Luis Cabrera de Cordoba, Madrid, 1619, 4to; History of Mankind, by Friedrich Ratzel, Vol. 3, London, 1898, 8vo; The Times Atlas, London, 1898, folio; Italian Valleys of the Pennine Alps, by S. W. King, London, 1858, 8vo; Three Years in Constantinople, by Charles White, London, 1846, 3 vols., 12mo; The Old World in its New Face, by Henry W. Bellows, New York, 1868, 2 vols., 12mo; Walks in Florence, by Susan and Joanna Horner, London, 1884, 2 vols., 8vo; Journal of a Tour in Italy, by Chr. Wordsworth, London, 1863, 2 vols., 12mo; Italian Byways, by J. Addington Symonds,

New York, 1883, 8vo; After Icebergs with a Painter, by Louis L. Noble, New York, 1862, 12mo; The Playground of Europe, by Leslie Stephen, London, 1871, 8vo; In Spain and a Visit to Portugal, by Hans Christian Andersen, New York, 1870, 8vo; A Step from the New World to the Old, by Henry P. Tappan, New York, 1852, 2 vols., 12mo; The Alpine Regions of Switzerland, etc., by T. G. Bonney, Cambridge, 1868, 8vo; The Life of the Moselle, by Octavius Rooke, London, 1858, 8vo; Field-Marshal Count Moltke's Letters from Russia, translated by Robina Napier, London, 1878, 8vo; Social Life in Munich, by Edward Wilberforce, London, 1863, 12mo; The Roof of the World, by T. E. Gordon, Edinburgh, 1876, 8vo; Whitaker's Almanack for 1899, London, 1899, 8vo; Who's Who, 1899, edited by Douglas Sladen, London, 1899, 8vo; Puerto Rico and its Resources, by Frederick A. Ober, New York, 1899, 16mo; With Peary near the Pole, by Eivind Astrup, London, 1898, 8vo; Commercial Cuba, by William J. Clark, New York, 1898, 8vo; Rhodesia and its Government, by H. C. Thomson, London, 1898, 8vo; One Way Round the World, by Delight Sweetser, Indianapolis, 1899, 16mo; Through the Yang-tse Gorges, by A. J. Little, 3d edition, London, 1898, 8vo; The Transvaal and the Boers, by W. E. Garrett Fisher, London, 1896, 8vo; The Italians of Today by René Bazin, translated by William Marchant, New York, 1897, 12mo; The Land of the Sphinx, by G. Montbard, New York, 1894, 8vo; The Mammals of India, by T. C. Jerdon, London, 1874, 8vo; The Desert of Sinai, by Horatius Bonar, New York, 1857, 12mo; Remains concerning Britain, by William Camden, (reprint), London, 1870, 8vo; The Races of Men, by Robert Knox, 2d edition, London, 1862, 8vo; What I Saw in Kaffir-Land, by Stephen Lakeman, Edinburgh, 1880, 8vo; Second, Thirteenth and Fourteenth Annual Reports, Geology and Natural History of Indiana, Indianapolis, 1880, 1884, 3 vols., 8vo; Observations on Italy, by John Bell, 2d edition, Naples, 1834, (2 vols. in 1), 8vo; History of Modern Greece, by J. Emerson Tennent, London, 1845, 2 vols., 8vo; History of the Egyptian Revolution, Mamelukes to Mohammed Ali, by A. A. Paton, London, 1863, 2 vols., 8vo; Ambushes and Surprises, by G. B. Malleson, London, 1885, 8vo; Travels in the Arabian Desert, by R. D. Upton, London, 1881, 8vo; Leaves from my Chinese Scrapbook, by Frederic Henry Balfour, London, 1887, 8vo; History of Cooperstown, by Hon. Isaac N. Arnold, edited by S. M. Shaw, Cooperstown, N. Y., 1886, sq. 16mo; Observations etc., made by Mr. John Bartram in his Travels from Pensilvania to Onondago, etc., London, 1751, *Reprint*, Rochester, N. Y., 1895, 8vo; History of New York, etc., by William Smith, Albany, 1814, 8vo; The Jesuit Relations and Allied Documents, edited by Reuben Gold Thwaites, Vols. XXXV–XXXVI, Cleveland, 1899, 8vo; Colección de Documentos Inéditos, Segunda Serie, Tomos 10, 11, Madrid, 1897, 1898, 8vo; Catalogue et Prix Courants, par Hector Bossange, Paris, 1845, 8vo; Catalogue of the Library of Harvard University, Vols. 1, 2, 3, and First Supplement, Cambridge, 1830–1834, 4 vols., 8vo; Catalogue of the Maps and Charts in the Library of Harvard University, Cambridge, 1831, 8vo; Bibliotheca Marsdeniana, by William Marsden, London, 1827, 4to; London Catalogue of Books: 1800–1822, London, 1822, 8vo; Essays and Lectures on the Early History of Maryland, etc., by Richard McSherry, Baltimore, 1869, 8vo; El Puchero: or, A Mixed Dish from Mexico, etc., by Richard McSherry, Philadelphia, 1850, 12mo; Dictionary of the Suahili Language, by L. Krapf, London, 1882, 8vo; Travels in Europe, Egypt, Arabia Petræa, etc., by Eugene Vetromile, New York, 1871, (2 vols. in 1), 8vo; The Saône, by Philip Gilbert Hamerton, Boston, 1888, 8vo; Memoir of the Life of Laurence Oliphant and of Alice Oliphant, his Wife, by Margaret Oliphant W. Oliphant, Boston, 1891, 2 vols., 8vo; Letters of Asa Gray, edited by Jane Loring Gray, London, 1893, 2 vols., 8vo; Bom-

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bay and Western India, by James Douglas, London, 1893, 2 vols., 8vo; Observations on Monsieur de Sorbier's Voyage into England, etc., by Thomas Sprat, London, 1668, 12mo; Memoirs of the Naval Worthies of Queen Elizabeth's Reign, etc., by John Barrow, London, 1845, 8vo; Continental India, by J. W. Massie, London, 1840, 2 vols. 8vo; A Visit to Italy, by Mrs. Trollope, London, 1842, 2 vols., 8vo; The Rambles of the Emperor Ching Tĭh in Këang Nan, translated by Tkin Shen, etc., London, 1843, 2 vols., 8vo; Visit to the Great Oasis of the Lybian Desert, by G. A. Hoskins, London, 1837, 8vo; Five Months at Cairo and in Lower Egypt, translation from the French of Gabriel Charmes by William Conn, London, 1883, 8vo; The Book of the Thames from its Rise to its Fall, by Mr. and Mrs. S. C. Hall, London (1864), 8vo; Bear-Hunting in the White Mountains, etc., by H. W. Seton-Karr, London, 1891, 8vo; The Career of Major George Broadfoot, C.B., in Afghanistan and the Punjab, etc., by Major W. Broadfoot, London, 1888, 8vo; A History of Harvard University, etc., by Benjamin Peirce, Cambridge, 1833, 8vo; Gazetteer and Business Directory of Ulster County, compiled by Hamilton Child, Syracuse, 1871, 8vo; Handbook of Arctic Discoveries, by A. W. Greely, Boston, 1896, 12mo; Remarks on the English Maps of Arctic Discoveries, in 1850 and 1851, etc., by Peter Force, Washington, s. a., paper, 8vo; Observations on Mount Vesuvius, Mount Etna, and other Volcanoes: etc., by Sir W. Hamilton, 2d edition, London, 1773, 8vo; From Home to Home: Autumn Wanderings in the North-West, by Alex. Staveley Hill, New York, 1885, 8vo; The Tides and Kindred Phenomena in the Solar System, by George Howard Darwin, Boston, 1898, 16mo; A Directory of Titled Persons for the Year 1899, edited by J. Whitaker, London, 1899, 8vo; Spinifex and Sand: Five Years' Pioneering, etc., in Western Australia, by David W. Carnegie, New York, 1898, 8vo; Harvard and its Surroundings, by Moses King, Cambridge, 1878, sq. 16mo; The Exiles of Florida: etc., by Joshua R. Giddings, Columbus, O., 1858, 12mo; A Pedestrious Tour of Four Thousand Miles through the Western States, etc., by Estwick Evans, Concord, N. H., 1819, 12mo; A Biographical Dictionary, etc., of the First Settlers, etc., in New England, by John Eliot, Salem, 1809, 8vo; The History of the British Plantations in America, etc., Part I, by Sir William Keith, London, 1738, 4to; The Concord Guide Book, edited by George B. Bartlett, Boston, (1880), sq. 16mo; The Isles of Shoals, an Historical Sketch, by John Scribner Jenness, New York, 1873, 16mo; Old South Leaflets, Vols. I–III, Boston, (1896), 12mo; The Sports and Pastimes of the People of England; etc., by Joseph Strutt (reprint), London, 1876, 8vo; Carte Topographique de l'Egypte, etc., construite par M. Jacotin, Paris, (1821), folio.

GIFTS.

From the Council of the South Australian Branch of the Royal Geographical Society of Australasia, Adelaide:

The Prehistoric Arts, Manufactures, Works, Weapons, etc., of the Aborigines of Australia, compiled, etc., by Thomas Worsnop, Adelaide, s. a., 1897, 8vo.

From the City of Duisburg, Prussia:

Plan of Duisburg in four sheets and one of text. Duisburg, no date.

From Mrs. J. Haven Emerson:

Description of the New-York Croton Aqueduct in English, German and French, by T. Schramke, New York and Berlin, s. a., 4to; The case of Elizabeth Rutgers versus Joshua Waddington, etc., with an Introduction by Henry B. Dawson, Morrisania, N.Y., 1866, 4to; Reports of Explorations and Surveys, etc., Isthmus of Darien, by Thos. Oliver Selfridge, Washington, 1874, 4to; Reports of Explorations and Surveys, etc., Isthmus of Tehuantepec, by Robert W. Shufeldt, Washington, 1872, 4to.

From Ginn & Co., Publishers:

Physical Geography, by William Morris Davis and W. H. Snyder, Boston, 1898, 8vo.

From Dr. Emil Holub, Author:

Ueber den Ausbau und die Eröffnung der Betschuanaland- und über die Beira-Bahn. Wien, 1898, 4to. (Reprint.)

From the Intercontinental Railway Commission, Washington, D.C.:

Report of the Commission, 3 vols., with Maps and Profiles, 4 vols., 4to. Washington, 1898.

From Israel C. Russell:

Glaciers of Mount Rainier, by Israel C. Russell, with a paper on the Rocks of Mount Rainier, by George Otis Smith, Extract from the 18th Ann. Report, U. S. Geological Survey, 1896-97. Washington, 1898, 8vo.

From Paul Eve Stevenson, Author:

By Way of Cape Horn: Four Months in a Yankee Clipper, Philadelphia, 1899, 12mo.

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NOTES AND NEWS.

THE SVERDRUP EXPEDITION.—The *Geographical Journal*, for February, 1899, prints an account of the objects and equipment of Captain Sverdrup's expedition in the *Fram* to the north coast of Greenland.

It is stated in a foot-note that the account

has been forwarded to the President (of the Royal Geographical Society) by Consul Axel Heiberg and MM. Amund and Ellef Ringnes, who contributed handsomely to Dr. Nansen's expedition, and who are generously bearing the entire expense of the present expedition in the *Fram*, the ship itself being provided by the Norwegian Government.

The objects of the expedition are thus set forth in this first official account:

It is the intention of Captain Sverdrup, with the aid of this ship, to force his way through Smith Sound and Robeson Channel as far north along the coast of Greenland as possible. Should it prove possible to take the *Fram* round the northern coast of Greenland and over to its eastern shores, this will be done, but the expedition did not base any positive calculations on this remote possibility. When the *Fram* has been forced as far north as the conditions will permit, the ship is to serve as headquarters for sledge expeditions for further exploration.

The principal purpose of these expeditions will be to explore and map out the northern mainland coastline, and to make an attempt to connect Cape Washington, the most northerly point known on the west coast of Greenland, with Independence Bay and Cape Bismarck, the extreme northern points on the east coast. In case such an expedition should succeed, the Danish Government has, in Scoresby Sound on the east coast, generously placed at the disposal of the exploring party a depot of provisions left there by Lieut. Ryder's expedition, 1891–92. The explorers will here find a place of refuge where they can make their winter quarters, if they wish, in order later on to return or proceed southward to more civilized regions, as circumstances may render advisable. With the *Fram* as starting point, other sledge expeditions will be sent out to explore the archipelago which may exist north of Greenland, and to make other more special investigations. This is, in short, the geographical programme of the new Norwegian arctic expedition, so far as it can be approximately outlined in advance.

More than two years ago (on the 12th of January, 1897), Mr. Peary laid before the American Geographical Society his project of exploration in the Arctic, summed up by himself in these words:

The conquest of the North Pole, the complete delimitation of the Greenland archipelago, the last of the circumpolar island groups, and the elimination from our maps of the unknown area between the 84th parallel and the Pole are important geographical desiderata.

Mr. Peary's address, from which these words are taken, was

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printed in full in the BULLETIN of this Society for 1897 (No. 1, pp. 116–121).

Capt. Sverdrup's plan, now revealed, is copied point by point, as if on tracing paper, from Mr. Peary's plan.

During the summer and autumn of 1897 there were repeated unofficial announcements of Captain Sverdrup's intended expedition, and Mr. Peary was moved to write to him, as follows:

BROOKLYN, N. Y., November 4th, 1897.

MY DEAR CAPTAIN,

Paragraphs and articles are appearing in the papers here to the effect that you intend going North with a party in the Fram next year, provisioned for several years, via the west coast of Greenland, Smith Sound, Robeson Channel, &c., with the intention of exploring the northwest coast of Greenland and attempting to reach the Pole.

As this is the very route and these objects the very ones proposed in detail by me to the American Geographical Society on the 12th of last January, and as my preparations for carrying out that project are already well advanced, these articles have created a distinctly disagreeable impression over here, and have caused and are causing such unpleasant reflections upon you that I am constrained to take this liberty of writing you and asking you to give me the authority to deny the statements.

With sincerest regards and the highest admiration for the masterly way in which you brought the Fram home, I am

Very sincerely,
R. E. PEARY,
Civil Engineer, U. S. N.

CAPTAIN OTTO SVERDRUP,
Christiania,
Norway.

Captain Sverdrup replied:

DEN 2DEN NORSKE POLARFAERD MED "FRAM"
LEDER: OTTO SVERDRUP

CHRISTIANIA, 7th Decbr. 1897.

MY DEAR LIEUTNANT.

I am in possession of your honored letter of the 4th p. Having been abroad I have not before now been able to give you an answer.

I beg to tell that you are in a mistake when you mean, that I intend to reach the pole. My expedition has only a scientific purpose and is going to make scientific explorations in the north of Greenland and to study the palæocrystical ice.

I take the liberty of congratulating you with your intention of reaching the pole by that way, which I do not think difficult.

I wish you good luck and remain, dear Sir,
Yours truly
OTTO SVERDRUP.

To this letter, written on paper which seems to affirm what the writer denies, Mr. Peary sent the following answer and with it the correspondence ceased:

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U. S. M. S. "ST. PAUL."
December 25, '97.

DEAR SIR:

I received your favor of the 7th in London, but the continuous demands upon my time gave me no opportunity to answer it. I note that you state that you have no intentions to reach the pole.

I still cannot believe that you are familiar with my project for further Arctic work as formally presented to the American Geographical Society on the 12th of January, '97, & I therefore enclose copy of that project.

You will see from this that my plan contemplates "Scientific Explorations in the North of Greenland."

I still can hardly bring myself to believe that you propose to devote your time, energy, and money, in an attempt to anticipate or duplicate work which I proposed nearly a year ago, and the preparations for the execution of which are well under way.

I am sure you will pardon me if I remind you that such action on your part, in entering a field in which I have been at work for several years and assuming objects which I have formally proposed for my own work, will be without precedent in the entire annals of Arctic Exploration.

Very respectfully,

R. E. PEARY.

CAPTAIN OTTO SVERDRUP.

THE GEOGRAPHICAL SOCIETY OF TOULOUSE is organizing an Exhibition of Scientific Apparatus for the measurement of time and of angles according to the decimal system, to be held at Toulouse during the sitting of the XXXVIIth Congress of Learned Societies, from the 4th to the 8th of April, 1899.

The Exhibition will embrace: clocks, chronometers, watches, etc., showing decimal divisions of the day, the half-day, the hour, etc.; circles, compasses, sextants, etc., etc., decimally graduated, for the circle, the semi-circle, the quadrant, etc., etc.

There will be attached to the Exhibition a collection, as complete as possible, of the geographical maps, the tables of logarithms, the decimal astronomical tables and the various memoirs already published on this question.

THE SUPPLÉMENT to Vivien de Saint Martin and Rousselet's *Nouveau Dictionnaire de Géographie Universelle* is approaching completion. The *fascicules* 13 and 14, just issued, begin with KAARTA and end with MZAB.

The volume of the *Dictionnaire* covering the letters K–M is now ten years old, and the *Supplément* has to render an account of the names added to the map within that period of active exploration and occupation, without neglecting those previously recorded. To Klondike, a name of yesterday, are devoted four columns, to the German Colony of Kamerun eleven and to Madagascar thirteen columns.

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No dictionary satisfies every demand, but the reader of the *Supplément* is surprised to find, under *Mexico*, a quotation from Elisée Reclus on the insalubrity of the capital, without a reference to the colossal drainage works completed in 1898.

THE ALMANACH DE GOTHA, for 1899 (the 136th year), has a new section, containing the texts of the most important treaties concluded during the previous year: that between Germany and China relative to the cession of Kiau-Chou; the Russo-Japanese treaty recognizing the sovereignty and independence of Korea; and the preliminary treaty of peace between the United States and Spain.

Another notable addition to the body of statistical information in the *Almanach* is a list of the stations of the German and the French men-of-war throughout the world.

PROFESSOR J. C. BRANNER, of Leland Stanford, Jr., University, California, contributes to *Modern Language Notes*, Vol. XIV, No. 2, a paper on Some Old French Place Names in the State of Arkansas. These, he remarks, are confined chiefly to the southern and eastern parts of the State and to the valley of the Arkansas River.

The explanations offered are such as are suggested by the words themselves, or by some circumstance connected with the localities; but Prof. Branner, like every man who has been caught in the thicket of etymology, is constrained to admit that few of the explanations offered in his paper are to be accepted without question.

In many cases, the more the word is studied the greater the uncertainty as to its derivation. *Bodcaw*, for instance, the name of a stream and a township in Lafayette County, is readily accepted as a clerical error for the French *Badeau* (as if *Bodcau*), as the stream is called in Louisiana, until it is known that the stream flows into Lake Bodcau, and the reader is lost.

Add to the natural sources of confusion in the careless pronunciation of the ignorant, in misapprehension of sounds, in clerical error and hasty association, the pitfalls dug for themselves and for others by the learned, and the plain man may well give humble and hearty thanks that his ways are not as the ways of the etymologist.

Prof. Branner explains the name of the *Canadian* stream in this fashion:

> *Cañada* (Spanish). Diminutive form of *cañon*, a steep-sided gorge.

The derivation is more than dubious, and in what Spanish grammar or dictionary is there found a diminutive in *ada?* Moreover, a word ending in a consonant loses no letter when the diminutive

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ending is added; and the word *cañon* is itself an augmentative of the word *caño*, a tube or pipe.

Under *Dardanelle*, the name of a town on the Arkansas River, is the remark:

> I do not know whether the name was imported from Europe, or, as is said of the European name, was derived directly from *dort d'un oeille*.

If such things are said, they should not be repeated. A man may make fritters of English and live, but it is not permitted to fly in the face of the French language and of common sense.

Mr. Robert T. Hill, of the U. S. Geological Survey, will address the Society on the 13th of March on the subject of Cuba: Its Resources and People.

The following Circular has been addressed to the Fellows of the Society:

AMERICAN GEOGRAPHICAL SOCIETY,

No. 11 WEST 29TH STREET.

NEW YORK, February 28, 1899.

THE AMERICAN GEOGRAPHICAL SOCIETY has long been hindered and straitened in its work by the inadequacy of its house, No. 11 West 29th Street.

For many years the Society has been endeavoring to accumulate a fund for the purpose of procuring a fire-proof building. This fund grows very slowly, and is still $75,000 or $80,000 less than the sum needed.

Meanwhile the value of land advantageously situated increases rapidly, and the building now occupied by the Society (11 West 29th Street) grows more and more unsuitable and insufficient. It affords almost no accommodation for readers and students. It is not fire-proof. Its shelf-room is inadequate, so that the library, which has grown to be one of the most valuable geographical libraries in the world, is scattered on five floors and much of it is boxed up and inaccessible. The need for a new house is pressing and imperative, but at the present rate of progress it will be many years before the Society is able to obtain one.

Under these circumstances the Council have thought it possible that the Fellows of the Society, and others interested in the cause of science and education, might be willing to come to the aid of the Society and by contributing, say $75,000, enable it to install itself suitably without delay.

Subscriptions of $5,000, $5,000, $5,000, $1,000, $1,000, $1,000, $1,000, and $250—amounting to $19,250—have already been offered, and it is hoped that you may be inclined to lend your aid towards establishing the Society fittingly in a centre where all its resources may be brought to bear upon the broad field of usefulness before it, in generous rivalry with the well-housed and highly endowed Societies of other countries.

Should you think favorably of this suggestion, any contribution which you may make will be most thankfully received.

CHARLES P. DALY,
President.

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OBITUARY.

Don Matias Romero.

Señor Romero, who had represented the Mexican Republic for nearly forty years at Washington, died in that city on the 30th of December last. He had but recently returned from Mexico, with the rank of Ambassador, the first accredited to this country by an American Government.

In his long diplomatic career he had won the respect and confidence of all by the solidity of his character and his unswerving devotion to duty. In the words of Señor Mariscal, pronounced in the Mexican Chamber of Deputies on the 17th of January:

> The mention of his name is sufficient to recall to the hearer the most absolute consecration to duty, the most unwearied tenacity in its discharge, the most religious scrupulousness in whatever concerned an obligation once accepted or a task once entered upon, to its very last detail.

Señor Romero was a member of the International American Conference and an earnest advocate of every measure which tended to bring the nations of America into closer relation with each other.

He was an indefatigable writer on the history and development of Mexico, and his authority on these subjects was widely accepted.

He had been, for more than thirty years, a Corresponding Member of this Society, and had contributed many papers to the Bulletin.

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TRANSACTIONS OF THE SOCIETY.

JANUARY–FEBRUARY, 1899.

The Annual meeting of the Society was held at Chickering Hall on Monday, January 16, 1899, at 8.30 o'clock, P.M.

Vice-President Viele in the chair.

The following persons, recommended by the Council, were elected Fellows of the Society:

Henry Emerson Wetherill, M.D., U. S. A.
D. Allen Knight, Philadelphia.
John W. Herbert, Helmetta, N. Y.
George M. Diven, Elmira, N. Y.
Samuel Insull, Chicago.
George A. Chace, Fall River, Mass.
William Irwin.
George E. Armstrong, Boston.
Benjamin Walworth Arnold, Albany.
George E. Matthews, Buffalo.
Matthias C. Arnot, Elmira, N. Y.
O. M. Baker, Springfield, Mass.
Judson Scott Todd.
Mahlon C. Martin, New Brunswick, N. J.
William Mahl.
Andrew Porter Alvord.
Harlan P. Beach.
Henry H. Lippincott, Cinnaminson, N. J.
John Lyman Cox, Philadelphia.
Byram L. Winters.
Robert Franklin Adams.
John Murray Mitchell.
Albert K. Smiley, Mohonk Lake, N. Y.
William D. Baldwin.
Charles S. Bartow.
Alfred B. Wilson, Washington.
Frank Russak.
Jacob Russak.
Aldis B. Browne, Washington.
Wallace Pratt, Kansas City, Mo.
Prof. Wilbur H. Siebert, Columbus, O.
Hugh J. Chisholm.
J. Frailey Smith.
James Powell, Cincinnati.
Franklin Phillips, Newark, N. J.
James W. Hinkley, Poughkeepsie, N. Y.

The Annual Report of the Council was presented and read:

To the American Geographical Society:

The Council respectfully submits the following Report for the year 1898:

The number of Fellows on the 1st of January was 1,139. The additions during the year number 122. The losses by death, resignation, etc., were 82, and the total Fellowship on the 31st of December, 1898, was 1,179, of which number 301 were Life Fellows.

The finances of the Society continue to be in a healthy condition. For details of

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receipts and expenditures reference is respectfully made to the Report of the Treasurer, herewith submitted.

The house now occupied by the Society is far too small for its needs and is not fire-proof; the funds do not, however, as yet warrant the purchase of land and the erection of a suitable building thereon.

The year's experience seems to show that the more frequent issue of the Bulletin has increased its usefulness and has given satisfaction.

The additions to the Library number 3,469, viz.: Books, 916, Pamphlets and Periodicals, 2,414; Atlases, 20; Maps and Charts, 119. Among the books it is proper to mention the complete Reports of the Challenger Expedition, in fifty large quarto volumes, a gift to the Society from the British Government.

All of which is respectfully submitted.

(Signed) HENRY PARISH,
Chairman.

NEW YORK, Jan'y 7, 1899.

The Report of the Treasurer was then presented and read:

REPORT OF THE TREASURER FOR THE YEAR 1898.

General Fund.

To the American Geographical Society:

The Treasurer respectfully reports that on January 1, 1898, the cash on hand pertaining to the General Fund amounted to $2,513 51

During the year the income was:

From Fellowship Dues	$9,195 00	
Interest on Invested Building Fund	9,575 71	
		18,770 71
		$21,284 22

The expenditures were:

For Salaries	$4,799 00	
" Publications	2,555 17	
" Library	1,499 83	
" Meetings of the Society	935 20	
" House and Insurance	873 27	
" Stationery, Postages and Sundries	439 62	
Transferred to Building Fund	9,000 00	
		20,102 09
On December 31, 1898, the balance on hand was		$1,182 13

WALTER R. T. JONES,
Treasurer.

NEW YORK, Dec. 31st, 1898.

The Committee charged with the duty of selecting candidates for the offices to be filled made the following report:

REPORT OF THE NOMINATING COMMITTEE FOR 1899.

To the American Geographical Society:

The Committee appointed by the Council, December 3, 1898, to nominate suitable

persons to fill the offices becoming vacant in January, 1899, respectfully recommend the election of the following named gentlemen:

For President—CHAS. P. DALY, LL.D., term to expire January, 1900.
For Vice-President—C. C. TIFFANY, D.D., term to expire January, 1902.
For Treasurer—WALTER R. T. JONES, term to expire January, 1900.
For Domestic Corresponding Secretary—Chandler Robbins, term to expire January, 1902.
For Councillors: Rear Adm. BANCROFT GHERARDI, U.S.N.,
WILLIAM G. HAMILTON,
HENRY HOLT,
CLARENCE KING,
CHARLES A. PEABODY,
Terms to expire January, 1902.

(Signed) L. HOLBROOK,
W. H. H. MOORE,
A. A. RAVEN,
Nominating Committee.

January 7, 1899.

On motion, duly seconded, Mr. Francis M. Bacon was authorized to cast the vote of the Society for the candidates, and they were declared duly elected.

The Chairman then introduced Mr. E. C. Barnard, of the U. S. Geological Survey, who read a lecture on the Yukon Valley and Exploration of the Forty Mile District (Klondike).

On motion, the Society adjourned.

A regular meeting of the Society (appointed for February 13, and postponed on account of a heavy snow-storm), was held at Chickering Hall, on Monday, February 20, 1899, at 8.30 o'clock, P.M.

Vice-President Moore in the chair.

The following persons, recommended by the Council, were elected Fellows:

Joseph Williamson, Belfast, Maine.
Mrs. Ellen Hardin Walworth.
Elmer F. Botsford.
Rev. E. B. Burroughs, Darlington, S. C.
Walter Luttgen.
James S. Newton, Holyoke, Mass.
B. Arthur Aycrigg.
Clement Buckley Newbold, Philadelphia.
Silas Farmer, Detroit.

The Chairman then introduced the speaker of the evening, Mr. H. M. Wilson, of the U. S. Geological Survey, who addressed the Society on the subject of Porto Rico: its Topography and Aspects.

Stereopticon views were thrown on the screen.

On motion, the Society adjourned.

The Council, at a meeting held on the 4th of February, awarded the Cullum Geographical Medal to Sir John Murray, in recognition of his many distinguished services to the cause of science, as summarised in the inscription :

AWARDED TO
SIR JOHN MURRAY, K.C.B.
NATURALIST, DEEP SEA EXPLORER
OCEANOGRAPHER
EDITOR OF CHALLENGER REPORTS
MDCCCXCIX.